DOCUMENT RESUME

ED 290 259	EC 201 720

AUTHOR	Murphy, Harry J., Ed.
TITLE	Computer Technology/Special Education/Rehabilitation: Proceedings of the Conference (2nd, Northridge, California, October 16-18, 1986).
INSTITUTION	California State Univ., Northridge. Office of Disabled Student Services.
PUB DATE	87
NOTE	302p.; For selected individual papers, see EC 201 721-722 and EC 201 724-734. For the 1985 Proceedings document, see ED 276 233.
AVAILABLE FROM	California State University Foundation, Office of Disabled Student Services, 18111 Nordhoff St., Northridge, CA 91330 ($14.95; California residents enclose $15.92).
PUB TYPE	Collected Works - Conference Proceedings (021) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC13 Plus Postage.
DESCRIPTORS	Accessibility (for Disabled); Adult Basic Education; Braille; Computer Software; *Computer Uses in Education; *Disabilities; Educational Media; Elementary Secondary Education; Interactive Video; Interpersonal Competence; Problem Solving; *Rehabilitation; *Special Education; Telecommunications; Vocational Rehabilitation; Writing Instruction

ABSTRACT

The following 25 papers (with their authors) are presented from a conference on computer technology in special education and rehabilitation: "Computers for Business--Computers for Life" (I. Keith Austin); "Rehabilitation and the Computer: How to Find What You Need" (Thomas Backer); "Computer Access Alternatives for Visually Impaired People in Employment Situations" (James Bliss); "Interactive Video Instruction for Hearing Impaired Students" (Daniel Campbell); "Laserdisc Technology in the Classroom" (Kim Creighton); "Telecommunications: A New Horizon for the Handicapped" (Pat Cunningham and Joan Gose); "Developing a Writing Lab for Older Disabled Students: Beyond Bank Street" (Farah Fisher); "Reducing the Anxiety in Computer Training" (Farah Fisher); "The Computer Access Project: A Program Model for Vocational Training and Placement for Individuals with Moderate to Severe Cerebral Palsy" (Susan Fleischmann); "Computer Use as a Tool in Vocational Preparation and Adult Basic Educational Curriculums" (Marguerite Harmon and Matthew Frantz); "Computer Aptitude: Learning Disabled Versus Non-Learning Disabled Junior High School Students" (J. Dixon Hearne, et al); "Social Skills Development and Microcomputer Use for Handicapped Adolescents" (Marie Hegwer, et al); "Standard Software for Our Not-So-Standard Hardware" (Tim Hendtlass); "Give Me Tools and I Will Do the Job" (Arthur Heyer); "Tactile Graphic Braille Display" (David Jaffe); "Adaptive Positioning" (Dennis Kviz); "Software for the Atypical and Severely Handicapped Student" (Jude Levine); "Low Cost High Tech: People, Equipment, and Money Resources" (Aimee Luebben); "Software Analysis for Educational and Clinical Utilization" (Aimee Luebben); "Contemporary Applications of Computer Technology: Development of Meaningful Software in Special Education/Rehabilitation" (Russell Mills); "An Interactive Videodisc-Computer Language Program" (R. Scott Osksa); "The Sonoma Voice: An Inexpensive VOCA" (Bob Russell); "The Importance of Keyboarding Skills in Computer Usage with the Handicapped" (Thomas Saka); "Adapting Microcomputers for Special Needs Adults at Pearson Hospital" (Edward Summers, et al); "The Child with Attention Deficit Disorder: Finding a Safe Place to Learn Problem Solving" (Cynthia Terwilliger). (DB)

PROCEEDINGS
of the Second Annual Conference

"Computer Technology/ Special Education/Rehabilitation"

California State University, Northridge
October 16-18, 1986

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality
- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

Harry J. Murphy
Editor

EC 201720

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Harry Murphy
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

To order additional copies of this Proceedings, please enclose $14.95 (California residents enclose $15.92) and send to:

Office of Disabled Student Services

California State University, Northridge

18111 Nordhoff Street

Northridge, CA 91330

Copyright 1987

California State University, Northridge

Office of Disabled Student Services

TABLE OF CONTENTS

**Computers for Business;
Computers for Life** 1
I. Keith Austin

**Rehabilitation And The Computer:
How To Find What You Need** 19
Thomas Backer

**Computer Access Alternatives For Visually
Impaired People In Employment Situations** 33
James Bliss

**Interactive Video Instruction For
Hearing Impaired Students** 39
Daniel Campbell

Laserdisc Technology In The Classroom 51
Kim Creighton

**Telecommunications: A New Horizon
For The Handicapped** 59
Pat Cunningham and Joan Gose

**Developing A Writing Lab For Older Disabled
Students: Beyond Bank Street** 77
Farah Fisher

Reducing The Anxiety In Computer Training 87
Farah Fisher

**The Computer Access Project: A Program
Model For Vocational Training and Placement
For Individuals With Moderate To Severe
Cerebral Palsy** 95
Susan Fleischmann

**Computer Use As A Tool In Vocational
Preparation And Adult Basic Educational
Curriculums** 111
Marguerite Harmon and Matthew Frantz

**Computer Aptitude: Learning Disabled
Versus Non-Learning Disabled Junior
High School Students** 131
J. Dixon Hearne, Mary Poplin,
and Carole Schoneman

**Social Skills Development And Microcomputer
Use For Handicapped Adolescents**.. 145
Marie Hegwer, Kathleen Harris,
and M. Diane Klein

Standard Software For Our Not-So-Standard Hardware 163
Tim Hendtlass

Give Me Tools And I Will Do The Job 181
Arthur Heyer

Tactile Graphic Braille Display 193
David Jaffe

Adaptive Positioning 199
Dennis Kviz

Software For The Atypical And Severely Handicapped Student 209
Jude Curtis Levine

Low Cost High Tech: People, Equipment, And Money Resources 225
Aimee Luebben

Software Analysis For Educational And Clinical Utilization 241
Aimee Luebben

Contemporary Applications Of Computer Technology; Development Of Meaningful Software In Special Education/Rehabilitation 255
Russell Mills

An Interactive Videodisc-Computer Language Program 267
R. Scott Osksa

The SonomaVoice: An Inexpensive VOCA 283
Bob Russell

The Importance Of Keyboarding Skills In Computer Usage With The Handicapped 295
Thomas Saka

Adapting Microcomputers For Special Needs Adults At Pearson Hospital 307
Edward Summers, Jean McIntyre,
Alain Brunel, and Joan Clarkson

The Child With Attention Deficit Disorder: Finding A Safe Place To Learn Problem Solving 323
Cynthia Terwilliger

Keynote Address

Computers for Business;
Computers for Life

I. Keith Austin
IBM Corporation
White Plains, New York

Today I would like to talk about IBM and our commitment to persons with disabilities. In the course of my comments I'll discuss some current and prospective technologies, and how we might better exploit those technologies to meet the special needs of the impaired.

One of IBM's basic beliefs is respect for the individual. And this is shown no more than in our commitment to the disabled person. Ever since the early days of the company, IBM has been committed to the hiring, training, and advancement of persons with disabilities. IBM hired its first disabled employee in 1914. Today, there are approximately 8,000 IBM employees with handicaps within the United States.

We started our first formal training program in 1942 at the Topeka, Kansas branch office where we taught typing and keypunch operations to people with cerebral palsy. The following year we established a training center in New York City - primarily for the blind. Disabled persons were taught skills in typing, dictation, and transcription, by instructors who also were impaired.

Today, we have more than 30 training centers for the severely, physically disabled. We set up these training centers in cooperation with not-for-profit organizations in metropolitan areas. Since 1975 over 1,700 programmers who are disabled have graduated from these centers. Our placement rate is more than 85 percent. Two of these training centers are here in California... in Los Angeles and San Francisco.

These training centers are in addition to the more than 40 training centers established for the economically disadvantaged throughout the United States.

I don't know how much you know about our company, but we place a good deal of responsibility on our managers. And one of their major tasks is to define job requirements that take advantage of a person's abilities and minimize restrictions a disability may pose. And they have the responsibility for hiring and training their employees, abled or disabled.

But we are aware that in IBM, as in any industry or interaction involving people, some people may feel slight discomfort in communicating, interacting, and hiring the disabled person. With that in mind, over the next two years all of our 30,000 managers within the United States will participate in an education program for hiring, accommodating, training, and providing a proper work environment for the disabled person.

We have recognized long ago that there are many highly qualified individuals who happen to be disabled. For example, here in California, I am told that between 50,000 and 55,000 students who are disabled are studying in the University and Community College systems. This represents a large pool of talented, qualified people, and a company is foolish if it does not take advantage of that talent coming out of your universities.

Now, let me talk briefly about some accommodations we provide that minimize the restrictions to people who are impaired. The first thing to realize is that IBM doesn't provide special equipment to people just because they have a disability. We provide special equipment to help all our people perform their jobs, be they abled or disabled. And this is a very important concept. We all need equipment to do our work in the most productive way - the secretary with a word processor, the computer programmer with a terminal and link to the host machine - and the blind person with a reading machine, text-to-speech synthesizer, documentation in Braille, and so on.

Let me give you a few examples. Our blind employees can use IBM 3278 terminals and personal computers with text-to-speech capability as well as Braille printers. Employees with hearing impairments have telecommunication devices that enable them to use telephones that communicate with others. They, of course, also have access to electronic mail as well. Captioned films and videotapes are available routinely for internal communications such as management messages, education and training. At meetings where we have hearing impaired employees, sign language interpreters are employed. Special feature keyboards have been designed to help employees overcome physical handicaps. Our 'think' magazine, which is an informational magazine provided by the corporation to all employees, is printed in Braille or provided on audio cassette for the blind person. In our auditoriums, we use either FM or infrared transmission to provide augmentation to the hearing impaired. Our bulletin board announcements are distributed electronically and available to the blind, using text-to-speech synthesis.

A year ago this month, we announced the voice communications option (VCO) card for the IBM personal computer. This electronic card has three major functions and addresses the needs of four major impairments a person might experience. The features on the card include voice recognition, speech synthesis and telephony. These three capabilities provide assistance or accommodation to the hearing impaired, speech impaired, visually impaired, and upper mobility impaired person. Let me explain.

The speech recognition portion of the card, with the proper application, will provide a keyboard emulation to the upper mobility impaired person who cannot use a conventional keyboard, using the speech recognition and the appropriate application, the individual speaks into a microphone to give instructions to the computer or to compose limited correspondence, and to have those words appear on the screen or printed out. Current speech recognition technology is limited to relatively small vocabularies - I'll speak of this again in a few minutes.

For the speech impaired and the visually impaired person, the text-to-speech capability on the card provides synthesized voice for the person who needs assistance in speaking, as well as a text-to-speech capability which simply pronounces or speaks what is on the video display tube.

The telephony portion of the card includes a modem, and with the augmented phone service application, allows a hearing impaired person with a PC to communicate with any touchtone telephone. This means it is not necessary to have a telecommunications device for the deaf (TDD) at both ends of a telephone line for a hearing impaired person to communicate. With the personal computer, the VCO card and the augmented phone service application, a hearing impaired person can communicate with his/her bank, repair shop, hairdresser, friends, relatives, and so on, by calling up any touchtone phone and having the person at the other end use the phone keypad to spell out words and communicate back to the hearing impaired individual.

Additionally, the modem on the card provides connectivity, for any individual, to any of the many electronic mail service networks such as Compuserve, Bitnet, Deafnet, Specialnet, Dow Jones, your banking network, etc. Therefore, this is a product not only for industry and the workplace but also provides additional capability for any person at home.

When you stop to think about it...these products and accommodations are really part of a larger picture. There has been a virtual explosion in recent years of business and personal productivity tools for persons in all walks of life - abled and disabled. Much of this progress can be attributed to two events:

- The introduction and proliferation of the personal computer, and
- The breathtaking improvements generally in electronics price performance.

The PC, of course, freed both users and developers from dependency on the mainframe computer, and its operation and programming staffs, and the PC's open architecture allowed personal technical innovation - hardware and software - to flourish. In fact, some people describe it as the base of a technical renaissance.

Price performance, of course, has been improving over the past 20 years at a 25-30 percent rate/year - at the electronic device level - which continually lowers the threshold of affordability and function. For example, we have seen memory prices decline from a few thousand dollars for 8,000 bytes to the current wholesale price of $6-8 for a 256K ram chip. Logic and DASD price performance has followed a similar curve.

As a side benefit of cheap computing power and the proliferation of personal computers, we've become aware of an astonishing wealth of technical initiatives within IBM - primarily based on the PC - with direct or potential application to the disabled. Invariably, these were developed by individuals with a personal motivation, not as part of their regular jobs. At the same time, we've found a growing number of institutions and individuals seeking grants for disability and special education research, utilizing the PC and related technologies. However, we did not have a centralized view of either our internal activities or external opportunities.

So, we have done several things over the past two years to improve our understanding of technology as it applies to personal productivity tools, with emphasis on potential use by the disabled. Last week, for example, we held our second "IBM Technical Symposium for Projects for Persons with Disabilities." Thirty-three papers were presented - by IBMers and by invited institutions and individuals, who had previously received IBM grants for research, rehabilitation engineering, and training for the disabled community.

I want to talk to you about this symposium for two reasons. First, it is news...just happened last week. Second, it illustrates the wealth of opportunities waiting to be exploited. I would like to share with you a summary of just some of the research we reviewed.

We are supporting clinical work at the University of Missouri at Columbia and at the Wadsworth Center for Laboratories and Research in Albany, New York. Both of these institutions are doing work which directly analyzes brain or cerebral signal output.

The University of Missouri work consists of a probability analysis of what word a person will, but has not yet, spoken, or a movement which a person will, but has not yet, initiated.

To execute a movement, the brain must initiate an appropriate command signal that details the correct peripheral muscles to accomplish the movement. While single nerve cell information for movement has been studied in animals, the authors believe that it has not been attempted with humans.

Using new signal averaging techniques and sophisticated methods of signal analysis, this project seeks to identify specific components of cerebral activity prior to movement which relate to some particular aspect of the movement. Two types of motion are being studied: a simple thumb flexing movement, and vocalization of a word.

Correlating specific cerebral activities with vocal or motor actions in humans represents the first stage in using a cerebral motor signal to direct a prosthesis device.

In a different technical approach to the same problem, the Wadsworth Center's project seeks with real-time computer analysis, to directly translate these signals to a binary data stream which can be mapped to a limited vocabulary, or to device control, similar to wheelchair movement.

Brain activity produces minute changes in electrical potential at the scalp, or EEG signals. Although the EEG is an enormously complex signal, a number of well-defined rhythms have been described. Each rhythm is distinguished by its frequency and scalp location.

Successful efforts have been made to train people to increase or decrease one or another of these rhythms in the hope that such rhythm alterations would be helpful in treating disorders such as epilepsy.

However, there has been no known concerted attempt to use these rhythms as a means for the brain to control external devices directly. There have been no efforts to determine whether individuals could learn to switch one or more rhythms on and off rapidly so that a computer could translate the EEG signal into a binary code. If these rhythms can be controlled, it may be possible to use different rhythms at different scalp locations to compose a parallel interface that can transmit binary code directly from the brain to a computer. Such an interface could serve a wide variety of functions for handicapped individuals.

Preliminary studies demonstrate that individuals can be trained to turn their sensorimotor rhythm on and off quickly and accurately, thereby communicating a binary code condition - '0' or '1' to a computer. Subjects were able to alternate the signal, thereby communicating 4 bit words; i.e., 0111.

Obviously, this is at the very advanced end of the spectrum of IBM activities to couple the computer and human needs. These efforts and similar research probably will require years of work to yield a substantial variety of practical products.

Earlier, I mentioned our Voice Communications Option (VCO) card for the personal computer and indicated that existing products have limited speech recognition capability. Now I would like to summarize some of the research which extends speech recognition to a 20,000-word vocabulary, and which now puts us in the range of nearly unrestricted dictation applications.

The speech recognition group at the IBM Thomas J. Watson Research Center has developed a large vocabulary, isolated word speech recognition system based on an IBM-PC-AT augmented with IBM signal processor subsystems. It's called Tangora, after a person, I am told, who holds the world's record, per Guinness, for typing speed - 147 words/minute/hour. I am sure that several of you have seen this technology in our TV commercial which demonstrated accurate recognition of the spoken phrase: "Please write to Mr. Wright, right away."

While the primary goal of this project is real-time document creation by voice, the recognition technology has applicability to people with different types of handicaps.

Tangora represents the latest effort in a research project that began in 1972. By 1984, the speech recognition group demonstrated a 5,000-word real-time system based on a midrange S/370 computer and 3 floating point array processors.

The present system represents both a reduction of the system to a PC-environment, and a significant increase in vocabulary. While the physical size of the recognizer has been dramatically reduced, the accuracy and features of the mainframe system have been maintained. This work was made possible by the development of an IBM VLSI signal processor chip - developed at our Zurich, Switzerland laboratory - A set of Personal Instrumentation (PI) cards to interface this chip to the IBM PC bus, additional memory and data acquisition modules.

To accurately recognize "Please write to Mr. Wright right away," the system must be context sensitive. The language model for the 20,000-word system was generated by more than 27 million words of memos, reports and electronic mail. This language model is geared toward business documents, specifically in the computer industry, since this was the area in which we had gathered large machine readable databases. Other fields of discourse could be supported, but comparable amounts of machine-readable text would be required.

The most obvious application of Tangora for people with disabilities is a variation on what the system was designed for: document creation by voice. For people without the ability to write or type, due to stroke, cerebral palsy, muscular dystrophy, or spinal injury, the current methods of communication include recording, dictation, and in severe cases, selecting individual letters from display boards. Even with the current limitations on recognition accuracy and speed, direct text creation by voice would certainly be a feasible alternative.

A somewhat less obvious application would be speech training aid for deaf children in oral schools. While learning to lip-read and use residual auditory cues through hearing aids, it might be advantageous for the students to "see" what the teacher is saying on a computer display. Speech teachers typically have excellent articulation, and could be expected to achieve high recognition accuracies. Also, these teachers often wear microphones coupled to the students' hearing aids. It would be a relatively simple matter to use this signal as the input to a Tangora.

The need to adapt technology to national language needs is well demonstrated by the work done at IBM's Tokyo Scientific Center, focusing on English-to-Braille translation.

In Japan, the number of blind students who wish to study English has been steadily increasing. There is, however, a severe shortage of English-to-Braillle translators, and students face virtually insurmountable difficulties in having materials transcribed into

Braille in time for classes. To overcome this shortage, the center set out to develop a system that would aid blind students by providing computer-based transcription of Braille for textbooks.

There are, of course, three levels of contraction in English Braille, grade-2 Braille is a writing method designed to save both time and space by using abbreviations. And in Japan, the English-in-Braille section of the university entrance examination uses this form.

One major problem confronting development of a computer-based Braille translation system is how to represent the rules of grade-2 English Braille on the computer. The difficulty arises out of the seemingly arbitrary nature of the contractions. For example, "ER" is usually contracted to one letter of Braille. When this takes place, for example, on the first "ER" of forerunner, however, understanding is impeded (the word is read as "for-erunner" vs. "fore-runner").

After studying reports on English-Braille translation systems developed in other countries, the center focused on a method which uses a word-translation table containing the rules of grade-2 English Braille, because of its flexibility, simplicity of expression, ease-of-use and maintenance.

Although the rules in this table present no special problems for native speakers of English, blind readers in Japan cannot always rely on context to make meaning clear, and hence need more exact, accurate transcriptions; these, indeed, should resemble as closely as possible, the manually translated English textbooks which they have read at schools for the blind.

In our work in Japan, we modified the table using 60,000 words from an English dictionary, and originally, about 400 rules. By referring to erroneously converted words, we gradually added new rules to the table, so that the new table now consists of about 1,100 rules. We then developed an entirely new system based on the refined table.

This system should greatly increase the number of English texts available to those with visual deficiencies. The first system was installed last January at the Japan Lighthouse's Information Center for the Blind.

Also for the blind is a workstation called PC SAID. It was developed at the IBM T.J. Watson Research Center.

PC SAID provides the blind or visually impaired user with speech output from a PC display, and does as simply, completely and conveniently as possible.

Typically, the user needs to make requests such as: "say line 21"; "speak the whole screen"; "where is the cursor"; "say the next line"; "spell the word under the cursor"; "what color is the character"; or, "say the next field."

Most of the commercially available access systems (there are about a dozen) use the PC keyboard for these requests. PC SAID uses a 16-key keypad, making requests quicker, and leaving the PC keyboard solely for the application. The independent keypad and PC SAID's unusual interrupt structure also supports compatibility with unmodified 3270 terminal emulation.

The actions of the keys on the PC SAID keypad are determined by a keypad profile. Requests such as those I've mentioned are part of a standard keypad profile on top of which the user can define application dependent key sequences. For example, the user may want to hear the "command line" or contents of the reverse video cursor, quickly and easily. A single key can be defined to give such information, not by searching, but immediately. Keys can also be defined to modify speech characteristics so as to take full advantage of the user's text-to-speech synthesizer, including the IBM Voice Communications Option (VCO).

I'd like to mention another technology - it was developed by our scientific center in Paris, and is known simply as our Vocalization Project, or "Teaching the Deaf to Speak." It was described in our first symposium in October, 1985.

The project uses existing signal processing technology, and a PC, to convert audible tones - vowels and consonants - into speech patterns on the PC's display. The student or patient then tries to duplicate the instructor's speech pattern, altering his/her speech tones until successful.

I'm not going to describe it further - you'll see it demonstrated here by one of my associates, Jane Jones, who is a computer science professional at our lab in Tucson, and a graduate of Northridge.

It's hard - in the abstract - to capture the excitement of the symposium. But it was exciting - both because it demonstrated the tremendous technical potential which lies ahead, and perhaps more important, the dedication and commitment of individuals to "make a difference."

But it takes more than good ideas and resolve to transform invention into reality.

Internally, our development organization is motivated by basic economics to build products for the lowest possible cost. That means new technology spread over a broad base. Our marketing organizations similarly are motivated to reach the broadest possible customer base with products and applications. I suspect we're no different than any other profit-making organization. That says several things to those of us who wish to be successful in providing products and accommodations for the disabled:

First, to exploit technology and price performance improvements, our initiatives must be part of the mainstream development activity as much as possible. We need to improve/extend the PC interface to a multiplicity of disabilities, not build custom PC's for each disability. We must, for example, provide an alternative start up or boot in the base PC system to the concurrent three key Alt-Control-Delete functions.

Second, we must communicate to our developers the requirements of persons with disabilities, and design our products from the beginning with those requirements in mind. Retrofitting, or modifying, already built hardware and software is extraordinarily expensive and yields - at best - costly, functionally inadequate, and obsolete solutions. This is a question of understanding requirements and developing the standards to implement those requirements consistently.

Third, we need to make our product offerings more visible and obtainable by our customers. This means progress in awareness, education, and distribution. Further, within IBM, we needed to improve the coordination of our grants program with our overall program of "Products for the Disabled."

How are we approaching this challenge?

First, we have established within our development organization a group - it's called "Product Initiatives for Persons with Disabilities". It has two major responsibilities. One is to establish design guidelines and rules - pertinent to disabled requirements - for all developers to follow. Its second responsibility is to identify promising product initiatives within IBM and "leverage" them into the marketplace, through IBM or non-IBM development and marketing channels.

Second, we have recently established a technical team in one of our product laboratories to be responsible for the actual development and release of specific products for the disabled ... products which are not candidates for mainstream development.

Third, last year we created the "IBM National Support Center For Persons With Disabilities" in Atlanta. Its mission is to provide information - via catalogs and an 800 number - about IBM and IBM compatible equipment which supports the disabled person. The center also demonstrates these products at major events, such as this one, and to our major accounts.

Finally, we have formed internally an advisory board of our principal organizations related to this activity, to insure that we are applying our resources as efficiently and consistently as possible.

If we step back a little, we can see similar fragmentation for the industry: Many organizations, public and private, involved in research, product development, manufacturing, and distribution; a large and diverse population of therapists, medical practitioners, institutions and so on, evaluating and prescribing products for their patients and clients; and 36 million individuals with disabilities -- the ultimate customers. How can we improve this process?

On the manufacturers' side, we have been working with Trace Laboratories and the Electronic Industries Association to develop standards for accessibility, and we are participating members of the White House Conference on Computer Accessibility.

I think this is very important, as it would reduce product differentiation for its own sake, provide a broader base for the manufacturers of special need devices and software to work from, and facilitate evaluation of our products by practitioners and customers.

We strongly endorse the efforts of groups like the American Foundation for The Blind's National Technology Center to evaluate our products and provide thoughtful, professional feedback to the industry on product requirements and improvements. And we believe that proposals for including computer and technology courses as prerequisites for graduation/certification should be carefully considered by those educational institutions who train individuals for careers as counselors, educators, and therapists for the disabled.

And finally, we applaud the efforts of the major foundations, such as the American Speech and Hearing Foundation, and individuals, such as Dr. Murphy, for creating, sponsoring, and organizing local, regional, and international seminars and symposiums such as this - to better communicate our ideas, accomplishments, and problems, and to share in the opportunities which lie ahead.

On behalf of the IBM Corporation, it has been my pleasure to visit with you this morning. Thank you for inviting us.

Rehabilitation And The Computer: How To Find What You Need

Thomas Backer
Regional Rehabilitation Network
Los Angeles, California

As in all areas of work and human affairs today, the problem in rehabilitation is not determining whether the computer can help solve problems and enhance success, but how to search through the avalanche of information for the right kinds of hardware and software to meet particular needs. We know the computer age is here, but finding what you need to meet certain objectives is not easy. In many ways, we're all the victims of the remarkable growth in the computer field -- there's a constant deluge of new developments and the superstructure to organize them hasn't kept pace.

The purpose of this presentation is to provide a very rough kind of superstructure for rehabilitation professionals, to help in searching for the computer hardware and software to serve their clients, and to improve their professional practices and the organizations in which they work. It covers four types of computer applications:

* assistive devices for disabled people
* software to aid in the rehabilitation process
* client assessment software
* software to aid in the management of rehabilitation organizations

The presentation also will examine five processes required in all these areas to make successful use of computer technology:

* goal definition - deciding what you want the computer to do for you - more than half of all failures in computer technology stem directly from inadequate or inappropriate goal definition
* search - identifying the right hardware and software - and search these days means being very wary of the cost of

consuming information; we simply don't have time to look at every possible input so we need strategies that help us be successfully selective

* strategic planning - for the structural, financial and user acceptance dimensions of integrating the computer into meeting a need or providing a service
* implementation - how to convert the strategic plan into an actual operation that does what you want it to
* maintenance - how to keep the system running smoothly and how to upgrade and improve it over time

Assistive Devices

These include:

* environmental control systems -- which use the computer to control lights, appliances, doors, windows, etc.
* speech devices -- computer-converted speech for nonvocal clients
* writing devices -- from special adapted keyboards to single key systems; even people who can move one muscle can have complete access to the computer today with the right interfaces
* telephone systems for the deaf and hearing impaired
* blind and vision impaired systems -- which can convert printed words into speech, braille or large print
* microprocessor controlled assistive devices - for mobility, manipulation of physical objects, etc.

Almost everyone in the general population already has some kind of computer-controlled assistive device in office, car or home. For disabled persons, these devices replace muscle, mobility, and sensory system loss as a consequence of disability

Rehabilitation Process

These include:

* computer assisted learning systems: e.g., the PLATO system for learning independent living skills
* computer-assisted rehabilitation counseling software, which actually guides a client working on a computer terminal through a counseling process. (These systems are still in the experimental stage but commercial application is near.)
* cognitive rehabilitation systems for assisting in the complex relearning process (language, thinking, perception, coordination) for stroke and brain injury patients

Today almost every part of the rehabilitation process--assessment, diagnosis, vocational exploration, counseling and placement -- are being computerized. So are psychological support services for those clients needing them.

These have advantages of 24-hour availability, endless capacity to repeat learning steps, and more. They are also costly, and may be seen inappropriately as a "magic pill" solution for much larger and more complex rehabilitation issues.

Client Assessment

These include:

* computer-assisted psychological/vocational testing -- the MMPI, SCII, and many other tests are now computerized, not only for scoring but also for interpretive reports.
* client assessment systems -- packages for prevocational

exploration and planning and also for vocational evaluation, including aptitudes, work experience, job interests, specific job-related skills such as language and mathematics. The client is assessed directly on the microcomputer, or sometimes with paper and pencil and performance tests, with client results then fed into the computer, which evaluates performance against a large database. A relatively complex and complete report is the result.

* job matching systems -- the client fills out a form or enters data directly on a terminal about his/her characteristics and interests and job history. Responses are compared by the computer with a database and matches are made for the client with appropriate job types or to actual local job or training openings

These systems are now being widely used as time-saving devices by state VR agencies and many other rehabilitation organizations. There have been both system difficulties and user acceptance problems in some cases, but these systems now are in rather wide use and seem here to stay.

Management Applications

These include:

* word processing systems -- a standard tool in almost all offices now, for preparation of letters, memos, etc.
* report writing systems -- software which custom-formats information into report forms, sometimes with highly technical specifications
* management information systems -- computer software which

maintains and manipulates information needed for the operation of an organization. The trend is towards integrated systems, with operation on a micro or mini-computer depending upon size and needs of the organization. Networking of computer installations permits a common database and operating system for multistation organizations.

Types of functions covered by an MIS include:

- financial - accounts payable and receivable, billing, financial reporting, staff payroll, fringe benefits, staff database
- client payroll (for workshops)
- client activities (productivity, quality)
- client behavior recording
- contracting/bidding
- development/fundraising
- planning
- database maintenance
- client records
- research

Software systems are available which are custom-tailored for state VR agencies; others are specialized to private-for-profit organizations, some for facilities and workshops, and some for rehabilitation hospitals.

Goal Definition

As already stated, too hasty implementation without defining goals is a major cause of failure in computer systems. The first step in good planning is goal definition:

* what problems need to be solved?

- why haven't previous solutions worked and how will the computer be able to do it differently?
- what will the operation of the organization or the life of the individual "look like" post the computer?

Search

Information resources that may be of value include the following:

Books

NATIONAL DIRECTORY OF REHABILITATION FACILITIES USING COMPUTERS, by Paul W. McCray and Thomas F. Blakemore. Available ($9.50) from Publications Office, University of Wisconsin-Stout, Menomonie WS 54751.

RRN INNOVATION DIRECTORY: COMPUTER APPLICATIONS, by Thomas E. Backer and Marian W. Trotter. Available from Regional Rehabilitation Network, 1849 Sawtelle Boulevard, Suite 102, Los Angeles CA 90025.

NONPROFIT SOFTWARE DIRECTORY and COMPUTER FUNDING DIRECTORY. Two companion volumes providing in-depth reports on 200 programs of grants and in-kind gifts for nonprofit organizations wishing to computerize, and 300 software packages for nonprofits. For more information contact Public Management Institute, 358 Brannan Street, San Francisco, CA 94107.

A DIRECTORY OF MICROCOMPUTER SOFTWARE IN THE HUMAN SERVICES, edited by Joseph F. Doucette. Available from Computer Consulting and Programming Consultants, 7553 Canal Plaza, Portland, Maine 04112.

MICROCOMPUTER RESOURCE BOOK FOR SPECIAL EDUCATION, by Dolores Hagen, Closing The Gap, Inc., P.O. Box 68, Henderson MN 56044.

Book Chapters and Articles

RRN Series on Computers in Rehabilitation, a collection of articles on computer applications for rehabilitation organizations. Available from RRN, address above.

Rehabilitation and computerization, by Gary Golter. In ANNUAL REVIEW OF REHABILITATION, Volume 5, edited by Elizabeth L. Pan, Shelia S. Newman, Thomas E. Backer and Carolyn L. Vash. New York: Springer Publishing Company, in press.

Computer access and applications to career counseling with vocational rehabilitation clients, by B.T. McMahon, E.J. Burkhead & J.P. Sampson. Available from NARIC, telephone number below.

Computer technology in rehabilitation counseling, by P. Schmitt & B. Growick. Rehabilitation Counseling Bulletin, 1985, 28, 233-241.

Newsletters

COMPUTER USE IN SOCIAL SERVICES NETWORK (CUSSN) nNEWSLETTER. Contact: Dick Schoech, CUSSN Coordinator, University of Texas - Arlington, P.O. Box 19129, Arlington TX 76019.

SMALL COMPUTERS FOR NONPROFITS. Contact: California Research Center, P.O. Box 92131, Pasadena, CA 91109.

AAMSI NEWS. Newsletter of the American Association for Medical Systems and Informatics. Contact: 4405 East-West Highway, Suite 402, Bethesda, MD 20814.

THE CATALYST. Contact: Western Center for Microcomputers in Special Education, 1259 El Camino Real, Suite 275, Menlo Park, CA 94025.

MICRO/PSYCH NETWORK. Contact: Professional Resource Exchange, P.O. Box 15560, Sarasota FL 34277.

COMPUTERS IN PSYCHIATRY/PSYCHOLOGY. Quarterly journal published by Marc Schwartz, MD, 26 Trumbull Street, New Haven, CT 06511.

There are also many periodicals on computer applications available in the commercial marketplace; at least some are likely to be at any newsstand.

Commercial Enterprises

Computer manufacturers such as IBM, Apple.

Software distributors.

Computer stores such as Computerland.

Search Services

NATIONAL REHABILITATION INFORMATION CENTER. Contact: 800/34-NARIC.

SOFTWARE CLEARINGHOUSE FOR HUMAN SERVICES. Contact: Walter LaMendola, Graduate School of Social Work, University of Denver, Denver CO 80208.

SPECIAL EDUCATION SOFTWARE CENTER. Contact: 800/327-5892.

Research Centers

School district/special education resource centers for computer applications.

University/college based resource centers.

User Groups

National, regional and local groups of users of computers in specific subject areas, such as Los Angeles-based Computer Users in Speech and Hearing of Los Angeles (CUSHLA).

Special Resources

Rehabilitation Engineering Centers, funded by National Institute of Handicapped Research, Department of Education.

Sensory Aids Foundation, Palo Alto, CA, a nonprofit organization which also publishes Sensus, a journal including reviews of software relevant to rehabilitation of persons with sensory disabilities.

Closing The Gap, Inc., a product and services organization, address given above. Organizes an annual conference on computers on special education and rehabilitation.

Strategic Planning

Once goals have been set for implementing a computer system and some essential information resources have been identified, the most critical step for proper implementation is the creation of a strategic plan for computerization. Ideally, this plan should be the result of collaboration among all staff who will be using the computer system once it is in place.

Major questions the strategic plan should address include:

* how will the computer system be financed? (out-of-pocket; public or private grant; donated hardware; credit, including credit supplied by computer hardware manufacturer/distributor)?
* will the system be leased or purchased?
* where will the hardware be housed?
* to what extent will software need to be customized?
* what staff persons (or others outside the agency) need to be involved in arranging system implementation?
* what problems of staff resistence have to be overcome?
* how will the new computer system interface with existing programs and resourses?

- what role, if any, is there for a computer consultant in the system implementation?
- if a consultant is to be retained, what contractual arrangements need to be worked out and how can the proper consultant be identified?
- what other organizations in the area have had experience with the hardware and software being considered for implementation?

Implementation

One of the major challenges in implementing any computer system is in de-bugging it. Implementers should start with the assumption that considerable de-bugging will in fact be necessary and plan for it. A computer consultant often can be helpful in this regard.

Maintenance

The needs of the organization with respect to a computer system will not remain static over time. Upgrading and response to changing organizational conditions will be needed. Also, there will be long-term maintenance and repair issues which should be negotiated up front with the agency providing service for system. Some functions now are simple enough that they can be handled by the rehabilitation organization's personnel, with proper training. Training courses and materials are available for staff to learn these repair techniques.

* * *

Following these steps -- which, granted, require additional time and effort will maximize the chances for success when a rehabilitation organization implements a computer system. Consistant experiences of adopting organizations have shown that hasty or unplanned implementation leads to problems later.

Note: In the Region IX States of Arizona, California, Hawaii and Nevada, technical assistance consultation on innovative client assessment and management information system software is available through the federally-funded RRN project.

For more information, please contact:

Ms. Rheta King
Senior Networking Associate
Regional Rehabilitation Network
1849 Sawtelle Blvd., Suite 102
Los Angeles, California 90025
(213) 479-3028

Computer Access Alternatives For Visually Impaired People In Employment Situations

James Bliss
Telesensory Systems, Inc.
Mountain View, California

The number and diversity of jobs involving interaction with computers are rapidly increasing, and many of these jobs potentially offer good employment opportunities for people who are visually impaired. For example, in a recent market survey of 1350 Fortune companies, 42% of the companies responding expected word processing jobs to double in the next 3 years. There will be an estimated 5.4 million word processing jobs by then. However, at the same time, there are increasing reports of jobs lost by visually handicapped people as new technology replaces old. The problem in the example is that adaptive devices, designed to read typewriters in the 70's, don't enable full utilization of today's word processors. As the technology gap widens, competitive employment is increasingly difficult. Training centers which were once comfortable preparing blind typists to use typewriters are now ill-prepared to train word processing operators. The word processing field is just one example in which new office technology can either result in new jobs, or reduced employment opportunities, depending on whether we can meet the challenge of providing appropriate adaptive equipment and training.

Large print, synthetic speech, and braille displays represent the three major technologies which can be applied to enable visually impaired people to work competitively where access to computers is required. For the job placement to be successful, appropriate technology for the individual must be chosen and provided in the form of reliable products which are supported with effective training, equipment service, and application engineering.

Today the purchaser of equipment for use by visually handicapped people is confronted by a confusing array of incompatible products, which need to provide access to another array of different kinds of office equipment and software. The combinations are enormous. However, if you want to choose one access system for visually impaired persons, with the idea of interacting with other equipment via file sharing hardware and/or software programs available, then the IBM PC is the system of choice. It offers the largest number of file sharing programs and the best chance of fitting into any environment. The IBM PC's ability to provide access to mainframes by emulating almost any terminal, is another important consideration. Ninety percent of the Fortune companies have IBM equipment.

A compatible family of products incorporating all three display technologies, either singly or in combination, and that accesses the IBM PC, can provide maximum flexibility and greatly simplify the necessary support system. The evolution toward such a family of products has been underway for several years at TSI. The basic family of products concept is illustrated in Fig. 1.

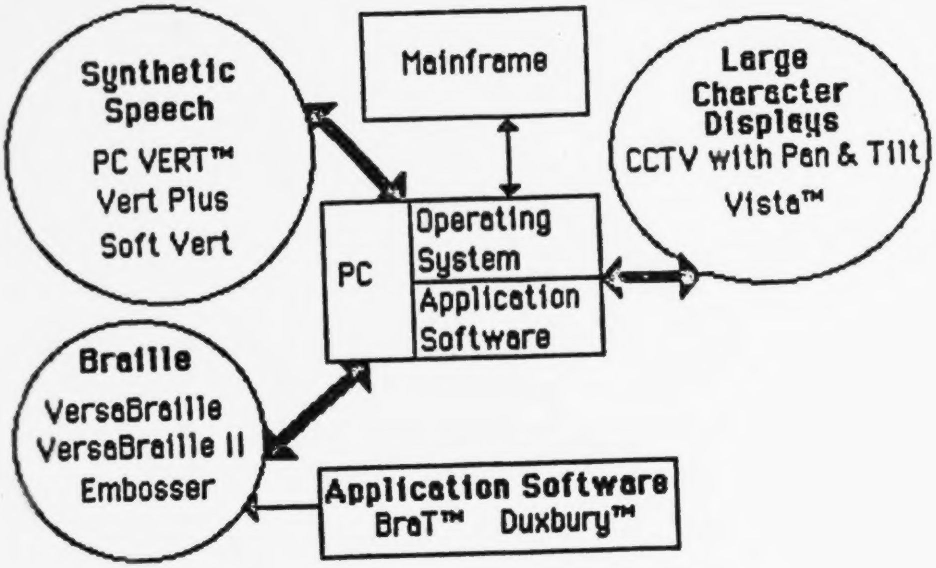

Synthetic Speech
PC VERT™
Vert Plus
Soft Vert
Mainframe
Large Character Displays
CCTV with Pan & Tilt
Vista™
PC
Operating System
Application Software
Braille
VersaBraille
VersaBraille II
Embosser
Application Software
BraT™ Duxbury™

Fig. 1 Family of Product Concept

With this approach, all products use software with similar command and control structures to drive each of the three display technologies, providing full screen review and navigation for access to off-the-shelf software with personal computers and mainframe systems. There is more than one product under each display technology, giving product "layers" to meet varying needs and budgets. Portable systems, with their own application software, are provided in braille for notetaking and word processing in meetings and while traveling.

Interactive Video Instruction For Hearing Impaired Students

Daniel Campbell
Southwest Collegiate Institute For The Deaf
Big Springs, Texas

Abstract

Instruction of hearing impaired students is greatly enhanced by the use of good visual aids such as videotape lessons and computer assisted instruction programs. Interactive video combines these two technologies enabling the instructor of hearing impaired students to design lessons in sign language which may also include written text, questions, branching, graphics and record keeping. Certain interactive video software packages, such as "The Instructor" by BCD Associates, Oklahoma City, Oklahoma, offer additional features such as the capability of activating a video camera during the interactive lesson to record student's signed responses. Interactive video also lends itself to the development of individualized lessons for teaching sign language.

Introcuction

During the past several years, since the advent of microcomputers, it has become increasingly evident that computer assisted instruction (CAI) is a very effective method for teaching/tutoring hearing impaired students (Rose & Waldron, 1984). The memory, logic and branching capabilities of the computer may be used to provide deaf students with the additional remedial practice they need in order to master difficult material (Smaldino, et al, 1983). The computer can provide instantaneous feedback, examinations, record keeping and drills which aid not only students but instructors as well. Computer effectiveness with profoundly deaf students is limited, however, in the area of graphic portrayal of language. Most profoundly deaf students do not read well enough to adequately understand or benefit from commercially prepared CAI programs. In addition, most commercially prepared software currently available is of very poor quality, (Stallard, 1982) or completely unvalidated (Hofmeister, 1982).

Video instruction using videotapes, videodiscs or films permits the use of sign language, cued speech and gestures in order to more effectively communicate ideas to deaf students. The live action, full color and actual sound of instructional video also make it attractive as a teaching tool. However, instructional video does not have the computer's capabilities of record keeping, testing and branching. Thanks to recent technological advances these two teaching tools, the video player and the computer, can now be combined to provide "Interactive Video" instruction.

A wide variety of interactive video systems are currently available. However, virtually all of these systems fit into one of two categories: (1) Interactive Videotape or (2) Interactive Videodisc. A brief summary of the most important advantages and disadvantages of these two types of interactive video is shown in Appendix A. In addition, a cost comparison analysis between two of the most popular educational interactive video systems, Videodiscovery (videodisc) and BCD Associates (videotape), is presented in Appendix B. It is important to note that, although the initial cost of the videodisc hardware/software in this comparison was less than that of the videotape materials, the additional cost of commercially prepared videodiscs negates this initial savings. Should technology become available to economically produce and edit videodiscs "in-house" the other advantages of videodisc, i.e. rapid access and durability, will probably make it the system of choice. Until then interactive videotape remains the more functional, and therefore desirable, of these two types of interactive video.

The BCD 400 System

BCD Associates, Inc. began producing interactive video interfaces and soft ware systems in 1979. The frame-accurate video tape positioning of the BCD 400 interface allows updating of even the most tightly edited programs to become interactive. Necessary hardware for use with this interface is listed in Appendix B.

The software produced by BCD Associates for use with the BCD 400 interface is entitled "The Instructor." "The Instructor" is technically called a 'Prompted, Screen-Oriented Lesson Authoring System.' It was specifically designed to encourage non-computer people to write and present computer assisted video instruction lessons. It is indeed much more "user-friendly" than the majority of interactive programs currently available. In operation, the system plays a short lesson portion of the videotape. The computer stops the videotape recorder and asks the student a question. If the student's response is correct, the system plays some more video. If the student's response is incorrect, the system may: (1) replay the same lesson video and branch back to the same question, (2) play a different section of remedial video or (3) display text or computer graphics for reinforcement.

When you begin authoring a lesson using "The Instructor" you are given a choice of nine different page types from which to choose (Appendix C). You can select any of these nine options for page one, then select another option for page two, page three, etc.. You can also branch your lesson from one page to any other page within that lesson.

On Information pages you can type two paragraphs of up to five lines each. You must remember not to use commas or colons as they will mess up the program. The text will also "wrap-around" at the end of each line so you must use the space bar to space to the end of the lines in order to avoid breaking words in half. Information pages may be followed by videotape segments(s) or by any of the other eight page types.

There are three different page types which can be used to ask the student(s) a question: (1) Question pages, (2) Keyword pages and (3) Menu pages. Question pages are simply multiple-choice pages. You type in a question of up to five lines followed by four possible answers. Each student response can be branched to a different video segment or page to give remedial help or positive/negative reinforcement. Keyword pages are like "Fill-in-the-Blank" questions. The student must respond to your question by typing a his/her response. Again, depending on the student's response, you can move them forward to new material or back to remedial segments. Menu pages are like Question pages except for two important differences. Your question on a Menu page is limited to only one line and you can have from one to nine different choices for the student(s) to choose from. Menu pages may also be used to ask True/False questions by designating response #1 as true and response #2 as false.

Graphics pages allow you to display previously prepared high resolution graphics at any point in your lesson. These graphics can be prepared using a "Koala Pad," "The Print Shop" or other similar graphics programs. Unfortunately, graphics take up a considerable amount of space on a computer disk. Adding graphics to a lesson rapidly fills up the program disk thereby limiting the length of the lesson which can be written. Slight modification of one program in "The Instructor," called "Cavos 3.0," will enable the system to access all graphics from the second disk drive. These changes in the program are described in Appendix D.

Video and Audio pages do exactly what their names imply. Video pages play a specific segment of video. Audio pages play the audio portion of a certain segment of the videotape.

Insertion of a Random Page in the lesson informs the computer to randomly select one of four possible branch pages as the next page to be displayed. Each branch page has a 25% chance of being chosen by the computer. Random pages add variety and interest to a lesson.

The last page type available in this system is the one with perhaps the most potential for use with hearing impaired students. This is the "Tape Record" page. When you insert this page into your lesson it turns on a video camera and records the student's responses to your questions! This feature requires a little extra preparation by the instructor since he/she must set up the camera as well as leaving blank spaces on the videotape at the appropriate place(s) in which to record the student's responses. The extra set-up/planning time is well worth it when you consider the multitude of possible uses for this feature especially with hearing impaired students. Students can be taught in sign language and can then respond to questions by signing their answers while facing the attached camera.

Applications In Deaf Education

The BCD 400 system has proven to be very useful with deaf students when used as a teaching aid (Dillingham, Roe, & Roe, 1982).

Lessons may be prepared in sign language on a variety of subjects and stored for student use. Students who miss class, for example, may be given the appropriate lecture videotape and accompanying computer disk so that they can not only view the missed lecture but can be asked questions about it and shown remedial material if necessary. Similarly, students who need additional help can use this system rather than always having to schedule time outside of class with their instructor.

The system also lends itself to teaching sign language. Stories told in American sign Language can be stored on a videotape. The instructor can then design lessons that will show a story and then ask the students questions about what they have seen. Incorrect responses may be branched back in the story to the specific segment in which the answer is contained. Students cannot advance to the next question until they correctly respond to the preceding one.

As mentioned previously, use of the Tape Record function enables deaf students to respond to the lesson using sign language. Naturally, the system does not have the capability to evaluate the correctness of signed responses. The instructor, or an instructor's aide, must take the time to check student responses and give appropriate feedback.

By far the most critical factor in the preparation of good interactive video lessons using this system is adequate planning. You must plan your entire lesson before writing any of it. Which page will branch to where? Where will you insert Tape Record responses? What do you want to teach students in the lesson? How will you evaluate the student's comprehension and retention of presented material? All of this must be considered before you actually sit down at the computer and begin to type your lesson. Adequate planning does not, of course, mean that no mistakes will be made during production. Fortunately, the system has built into it fairly easy to follow instructions for correcting errors. Still, it is far less time consuming to do it right the first time than to try to go back and correct large sections of your lesson.

References

Dillingham, L.M., Roe, J.J. and Roe, M.D. Selected applications of Computer-Assisted Video Instruction in the Education of Hearing Impaired Students. American Annals of the Deaf, 1982, 27, 652-658.

Hofmeister, A.M. Microcomputer in perspective. Exceptional Children, 1982, 2, 97-192.

Rose, S., and Waldron, M. Microcomputer use in programs for hearing-impaired children: A national survey. American Annals of the Deaf, 1984, 29 338-342.

Smaldino, S., Schloss, P., Goldsmith, L., and Selinger, J. Analysis of the relative instructional efficiency of microcomputer-based instruction and teacher-directed instruction for hearing-impaired and normal-hearing youth. American Annals of the Deaf, 1983, 28, 642-647.

Stallard, C.K. Computers and education for exceptional children: Emerging applications. Exceptional children, 1982, 2, 97-192.

Appendix A

VIDEOTAPE-VS-VIDEODISC

ADVANTAGES & DISADVANTAGES

VIDEOTAP (BCD)		VIDEODISC (Videodiscovery)	
Adv	Disadv	adv	Disadv
1) Production/editing of video "in-house"	1) Cost*	1)Cost*	1) No "in-house" production or editing
2) "User Friendly"	2) Limited Videotape life	2)Durable	2) Requires user to have knowledge of programming
	3)Slow video access	3)Rapid video access	

*Initial costs for the basic interactive videodisc system are somewhat less than for the videotape system. However, the cost of additional videodiscs from the manufacturing company will soon outweigh this initial advantage.

Appendix B

INTERACTIVE VIDEOTAPE-VS-INTERACTIVE VIDEO DISC

COMPARATIVE COST ANALYSIS

Item	Unit Cost	VCR Total	Disc Total
Apple IIe + Acc	$800	$800	$800
Duodisk + Acc	$500	$500	$500
BCD 450 Interface	$600	$600	
SLO-325 VCR	$1,650		$1,650
Videodisc Player	$950		$950
Biology Disc	$500		$500
VCR Software	$400	$400	
Disc Software	$150		$150
Color Monitor	$500	$500	$500
		$4,450	$3,400

Videotape Software/Hardware Source:
Source:

BCD Associates, Inc.
205 Broadway Tech Center
7510 N. Broadway Extension
Oklahoma City, Oklahoma 73731166

Videodisc Software/Hardware

Videodiscovery
P.O. Box 85878
Seattle, Wa. 98145-1878

Appendix C

THE BCD SYSTEM - AUTHORING A LESSON

PAGE TYPES AVAILABLE:

1) INTRODUCTION
2) QUESTION
3) KEYWORD
4) MENU
5) GRAPHICS
6) VIDEO
7) AUDIO
8) RANDOM
9) TAPE RECORD

Appendix D

PROGRAM MODIFICATION TO ACCESS GRAPHICS FROM DISK DRIVE #2

Making the following simple changes in the BCD interactive software, "The Instructor," will enable you to store all your graphics on disk drive #2. The program will automatically revert to drive #1 after loading the graphic(s) from drive #2.

Changes to Program entitled "Cavos 3.0"

Retype lines 320 and 3730 of Cavos 3.0 as follows:

```
320 PRINT D$; "OPEN" + LS$ + "-LESSON,L450,D1"

3730 IF GL$ <> F$(1,2) THEN VTAB 23: INVERSE: PRINT "LOADING
     GRAPHIC": NORMAL: PRINT D$; "BLOAD"; F$(1,2);", A$400,D2":
     &F$(1,2), GL$: &F$(1,2), GL$
```

Note*** The areas highlighted above are the commands which must be added to each of these lines.

Laserdisc Technology In The Classroom

Kim Creighton
Teaching Technologies
San Luis Obispo, California

Educators will generally agree that there are at least three criteria for good learning: 1) Access to quality information; 2) The ability to interact with that information in a meaningful way; and 3) Feedback as to the level of understanding of that information. Using the laserdisc interfaced with a computer allows educators to create lessons that meet these criteria. Creation of lessons can be easily accomplished by using a simple authoring system called LaserWorks. This system allows for at least five different uses: 1) Archival; 2) Demonstration; 3) Illustrating lectures; 4) Interactive; and 5) Student reports.

Most educators would agree that learning is at the heart of education. Most educators would also agree that there are at least three criteria for learning.
Those criteria are:

1. Access to quality information.
2. The ability to interact with that information in a meaningful way.
3. The ability to receive feedback as to the level of understanding of the information.

The marriage of the laserdisc with the microcomputer gives the quality information we desire as well as the access, feedback, and control we need to use it effectively.

The laserdisc is a marvel of today's technology. It looks like a 21st century phonograph with its shiny aluminum surfaces. The aluminum contains laser-created pits and smooth spots that are translated by another laser into the audio and visual information we wish to access. That fact alone is one of the greatest advantages of laserdisc. Because the information on the disc is in the pits and smooth spots , there is no film to fade, tape to stretch, or vinyl to be scratched. That means that the information stored on the disc will not distort as easily as other mediums with normal use.

Another advantage of this medium is the amount of information it can store. A single 12" laserdisc has the potential to store the equivalent of 108,000 slides. That number is equivalent to 1350 eighty slide carousel trays. Plus, the information stored can be from any previously used medium such as films, graphics, text, electron microscope slides, etc.

Laserdiscs are also indexed to allow random accessibility. Most educational discs are indexed by chapters and individual frame numbers. Other discs are often indexed by minutes only or minutes and seconds.

The variety of information available on laserdisc is extensive and constantly expanding. These topics are all covered on laserdisc:

* The entire collection of the National Gallery of Art.
* The NASA 3-D photographs from flybys of Saturn and Mars.
* Microscopic slides of blue-green algae or conjugation fungi.
* A complete Palomar sky survey.
* The history of aviation and space flight from the National Aeronautic and Space Museum archives.
* Slides of rocks and minerals.
* The flags of the world.
* Films of the repair of Solar Max.
* Slides of mammals, birds, plants, insects, spiders, and fish.
* Aerial photos of vegetation zones and landforms.

* Slides and diagrams of mitosis, chromosomes, protein synthesis, and the structure of DNA and RNA.

Connecting a microcomputer with the laserdisc allows quick access to and interaction with the information it contains. In its simplest form, the marriage creates problems for the majority of users who don't know how to speak the language of the laserdisc player.

That problem has been addressed by the creation of an authoring system called LaserWorks. LaserWorks allows the user to easily create lessons specific to their needs. It uses English (not computerese) cues to help the user make necessary decisions. For example, to put a page of text in the lesson, the command Text is used. To include a frame from the laserdisc, the command frame is used. LaserWorks thus allows for the simple creation of lessons at any level of sophistication and with different methods of presentation.

There are several ways to use this system. Following is a description of only five. These are archival, demonstration, illustration of a lecture, interactive, and student reports.

The use of the laserdisc as an archive is the easiest use to see. The teacher can ask the laserdisc to display any information it contains in any method of organization desired. An art history lesson can include examples of 19th century French painting, Impressionist paintings, paintings by Renoir, or a selection of works with a similar theme. The zoology lesson can include pictures of vertebrates, invertebrates, freshwater and marine animals--a huge choice of high resolution close-ups are at the fingertips of the instructor at a moment's notice. The history lesson can offer maps, diagrams, documents, costume examples, and trade routes. The astronomy lesson can show NASA photos of the sun, moon, Jupiter, or the making of the space telelscope. This is information at its best and most abundant. The laserdisc can also be used to demonstrate and teach activities that require movement. Actual hands can be shown making intricate Origami folds. Entire lessons in sign language or knot tying can be given. Dances can be demonstrated. All can be shown with complete control of the action at the touch of a key. Back up, go forward, play in slow motion, play with stop action--all of these are possible without rewinding and searching, and without resolution loss.

Using two different screens (one for video and one for text) allows for the third use of the system, illustrating lectures. A teacher may want to present a lesson on cell division. It would be possible to have a slide showing a phase of division with either a title or a full-page description of the phase on the other screen. A variation would be to use the system in a learning center type of situation. An entire lesson could be presented with text and audio/ visual materials presented simultaneously on separate screens. The system could also be used to provide reading practice. A series of pictures could appear on one screen with their names on the other screen.

A more exciting use of the system is for interactive lessons. This means the student must actively participate i the lesson causing interest to be maintained and learning to be enhanced.

In the following interactive lesson, the computer presents information, asks for a response, and then directs the student towards more critical observation. (1)

After having reviewed information on insects, a student comes to a screen that asks him to look at the following animals closely because he will be asked about their most obvious similarity. The student pushes a button and a series of four dragonflies appear. The computer then asks, "What characteristic did all those dragonflies have in common?" The student responds with, "Beautiful wings". The response from the computer is, "You're right, they do have wings, but did you notice how many? The number of wings can be important in classifying animals." After reading this, the student is given another chance to answer the question. The student types in "Four wings" and the computer responds with, "You're right. They have four wings. A good observer notices details such as the number of wings."

The student in the above lesson could have answered the question in a number of different ways. The computer would have responded to each response in a way deemed appropriate by the creator of the lesson. With that type of feedback, the student would know how well the material had been understood and what topics needed to be reviewed.

The fifth way to use the system is to allow students to write their own reports. With only minimal instruction students have created reports, peer teaching lessons, and oral reports that utilize the audio/visual information available.

Keep in mind the uses described above are only a sampling of the many ways this system is currently being used. Teachers are constantly discovering new applications for this new technology. The information available and the ease with which it can be accessed gives educators a wonderful new tool that is limited only by the user's creativity.

Footnotes

(1) This lesson was taken from a software lesson written by Dr. Robert L. Blodget. It is not available for commercial distribution.

Telecommunications:
A New Horizon For The Handicapped

Pat Cunningham and Joan Gose
Mesa Public Schools
Mesa, Arizona

Overview of Telecommunication - What It Is.

Telecommunication is one of the most popular computer applications. By connecting your computer to a modem (through a phone line) and then dialing, you can access commercial servicers or local boards. Appropriate communications software and hardware insures easy access to public boards, private boards and commercial services.

The scope of telecommunications has expanded dramatically. Telenet, Compuserve, The Source and others offer many services beyond information retrieval and electronic mail. You can post a "letter" in seconds, look up a particular topic in an electronic encyclopedia, get the latest news from the wire services, look at stock prices, make airline reservations, or shop at home. Utilizing other services, you can bank, take college courses, or play an electronic game. With the capability for online conferences and "chats", lasting friendships can be made even though two people may never see each other.

In short, telecommunications is an exciting computer application directly impacting our society. We have sited only a few applications. The field is expanding and changing rapidly. According to the U.S. Commerce Department 50 million Americans will be using online services by 1995.

One popular application is twenty-four hour home shopping. Online shopping offers a variety of name brand products, usually at a discount. Examples of some of the products offered are appliances, electronic equipment, cameras, typewriters, household furnishings, sporting goods and much more. Shopping involves a few seconds to get "online". You can look at what is available, make you selection, and purchase items by charging the order to your credit card. Your purchase is then mailed to you.

Online banking is another feature of telecommunications. Nearly all banking services are available through your computer and modem. You can inquire about your account, pay bills, transfer funds, and receive travelers checks. Security for banking is provided by passwords and user codes.

Electronic learning is rapidly expanding. Corporations, colleges, and universities are becoming involved. This is an area of promise for physically handicapped students. Time and distance are no longer restrictions to a disabled person pursuing a higher educational degree.

Recently, several colleges and universities have begun to pursue online education through Telelearning. At present they include the University of Nebraska, Ohio University, San Diego State University, the University of Wisconsin, American Open University of the New York Institute of Technology, DeAnza College of Cupertino, California, and Central New England College in Worcester, Massachusetts.

Typically, each school develops its courses, then forwards them to Telelearning to be incorporated in the online network. Courses offered by participating universities and colleges can lead to BA or MBA degrees. You can also take seminars and special interest classes. Credits are received from the participating school.

What It Offers:

Special educators have the responsibility to prepare students for independent living in an increasingly technological world. Students graduating now are potential members of the work force until the year 2031. We feel that now is the time to prepare physically handicapped students to take advantage of this technology. They can be acquiring skills which will enable them to independently pursue job training, advanced education and greater independence.

Computer related job opportunities are one of the fastest growing segments of the job market. Examples of computer related jobs are as follows:

1. Programming at home (major electronic manufacturer)
2. Editing/proofing (local newspaper)
3. Consulting
4. Other types:
    a. Online accounting
    b. Tax preparation
    c. Information research specialist
    d. Technical writing
    e. Desk top publishing
    f. Mailing/clipping services
    g. Systems analyst
    h. Almost any computer related job which could be done remotely

Because of telecommunications, many of these jobs will be able to be performed at a location other than the office; namely, home. It will be possible through telecommunications to make use of capable minds often restricted in non-compliant bodies.

Case Study:

At Mesa High we have had access to telecommunications for more than three years. For the past two years the physically handicapped class has operated a computer bulletin board.

WHAT IS NEEDED TO GET STARTED

I. Hardware and software needed.

The following is a list of approximate costs to set up a system. Choice of computer should be base upon the individual needs of your students. Any computer will support telecommunications if equipped with the appropriate hardware and software.

EQUIPMENT	COST	COMMENTS
Computer/monitor/disk drive	$ 700 - 2000	2nd disk drive + $200: color monitor + $200
*Modem - 300 baud	$ 50 - 150	1200 baud costs $250-500 - some require interface card - check with your dealer
Printer/interface card	$ 200 - 600	
Communications program	$ 0 - 150	Public Domain - Free/low cost Commercial - $50 -150 Preview before buying, look for one key commands, preview manuals for readability
Adaptive devices	Varies	
Mouthsticke	$ 5	
Adaptive firmware card	$ 350	Available from several sources, allows scanning and single switch input
Expandable keyboards	Varies	Some are programmable; direct selection or scanning
Electronic boards	$1500 and up	Scanning or direct selection - any type of switch input i.e. eye scan, voice, EMG, etc.
*Phone Lines	Cost varies	Compatible with dialing system i.e. rotary pulse or touch tone

The Bulletin Board System (BBS) has been a valuable in contacting resource people. Many of the people who have assisted the program were initially contacted through help requests posted on local BBS'S. One parent hired an attendant for her child after "chatting" with him on the BBS. We have received two donated computers through BBS generated contacts.

In the academic area non oral students have been motivated in written communication by the mailbag feature of local bulletin boards. Computer pen pals have expanded the often limited social contacts of our PH students. In one instance a BBS pen pal blossomed into a dating relationship between a non oral PH student and another regular education student. In contrast, a student who was disappointed at not receiving mail was found sending himself messages.

The BBS has allowed contact between the high school PH program and junior high PH program. Therapist and teachers have used the mailbag feature to encourage students to communicate in personal and academic areas. At present, there are about 200 school and public users of our system.

Finally, physically handicapped students using telecommunications are looked up to as "experts" by other able-bodied students. It has greatly enhanced their mainstreaming and social opportunities. Roles are reversed when the able-bodied student is dependent on the disabled student for assistance within the computer area.

It is apparent that telecommunications and all its benefits are just as accessible to the physically handicapped user as to the able-bodied user. More importantly, telecommunications gives the physically handicapped user opportunities to interact with the environment that did not exist before. With a few modifications of equipment or addition of peripherals such as switches or electronic communication boards, physically handicapped persons can participate in this area.

Implementing Technology In An Educational Setting

Administrative Implications:

In any implementation of new technology, inservice needs must be recognized and addressed. Buying a piece of hardware or software will not insure its use and is often counterproductive. The frustration involved in trying a new piece of equipment without hands on experience, is likely to have a negative effect and lead to disuse.

The optimum scenario is to allow released time for teachers to be inserviced. They are more ready and willing to commit the time when it is part of their working day. After the initial training it is important to have ongoing support available to answer the inevitable questions.

Another major consideration is funding. If the class already has a computer and printer, a modem and communications software are relatively low cost items and can be ordered using usual district procedures. When you're looking at setting up the whole configuration, cost is a factor you will have to address.

We were able to obtain our initial hardware by writing a proposal to our Assistant Superintendent. It is important to state why the equipment is necessary, how it will be used, and instances of successful use i.e. other districts, research data, etc. in your proposal. While the benefits of using technology with handicapped students is obvious, the educational benefits must be stressed.
In our case, a computer and printer is to our handicapped students

what paper and pencil is to non-handicapped students. This rationale was used in our proposal.

Another alternative is to find outside funding sources. Other funding sources may be local service organizations, P.T.O. groups, private companies or grants. The Handicapped Funding Directory, Research Grant Guides, P.O. Box 357, Oceanside, N.Y. is a guide to funding sources throughout the United States. Besides a listing of corporations and foundations, it gives specific requirements for applying to the Apple Grant Program. Local users groups or computer stores may also have information on how to obtain low cost hardware and software. This is an area where creativity helps.

Appendix I

Problems and Solutions:

We have experienced the following problems and solutions in using telecommunications and with our BBS.

PROBLEM: Software programs: Beware of privately written "free" BBS programs. We have spent many frustrating hours attempting to operate a "buggy" public domain program. Our program required extensive programming expertise and contained little documentation. We eventually abandoned it in favor of a purchased user friendly system. Local BBS (systems operators) were the best resource in selecting an appropriate program.

SOLUTION: We have found the following features desirable in a BBS program; password capability, a user log with the capability of printing selected portions, uploading, downloading, multiple boards with security levels, time limit (this requires a clock card), single keystroke commands, electronic mail and user friendly menus. We have found it is helpful to subscribe to several computer magazines. Most magazines feature a monthly telecommunications column. Compute, A+, Family Computing, Linkup and Popular Computing are only a few of the many useful monthly magazines.

PROBLEM: High cost of equipment and adaptive peripherals. Costs range from a

$5 mouthstick to a $3,000 communications board.

SOLUTION: We have found the Adaptive Firmware Card to be an easy to use scanner. The scanning takes place directly on the screen rather than on an adjacent keyboard. At approximately $350, this represents a considerable savings if interfacing with the computer is the only needed application.

PROBLEM: We could not operate the modem. Hours were spent with high school computer teacher and student "whiz kids" trying to decipher manuals written by and for the technically minded. A service call to a technician revealed our modem supported rotary pulse dialing while our school line was touch tone only.

SOLUTION: Installation of a separate, dedicated phone line, cost six months and $$$. Some new modems are compatible with both rotary pulse and touch tone - check it out before buying!

PROBLEM: Communications program supplied with modem doesn't allow saving or printing of data.

SOLUTION: Purchased software that allows data capture. Cost $125.

PROBLEM: Slow response time by students.

SOLUTION: Slow response time is minimized by our communications program which uses abbreviated key strokes for dialing and logging-on. It also has a built in text editor which allows students to prepare messages of any length while offline then send the entire file using a few key strokes. Case: A physically handicapped student prepares a letter offline in 30 minutes and sends it to her mother's home computer in less than one minute.

PROBLEM: The electric wheelchair motors caused system crashes.

SOLUTION: This was not a software problem but apparently static electricity. Spraying/wiping the area with fabric softener minimizes the problem.

PROBLEM: System crashers and anonymous obscene messages.

SOLUTION: October 1984, Link-Up "Crashproofing your BBS" by David Rolhman suggests:

1. Set up log-on codes and passwords
2. Limit the number of calls per day (clock card is needed) to three
3. Make callers disclose names, addresses, and phone number
4. Control secure software (all can be crashed)
5. Use secure software (all can be crashed)
6. Make electronic back-up daily
7. Charge membership fees
8. Check with local systems operators for names of crashers
9. Use disk recovery programs

Appendix II

Resources

In addition to the items previously mentioned for telecommunications, BBS software is necessary. There are several commercial programs available. The following are for Apple/Franklin boards. Commercial programs are available for other brands of computers.

ABBS Version 4.0
Software Sorcery
7927 Jones Beach, Suite 400
McLean, VA 22102

GBBS II
System Version 1,7
Micro Data Products
5739 S. Olathe Court
Aurora, CO 80015
(303) 680-9292 modem (303) 699-1161 Voice

NET-Works
Nick Namio
4877 Martin Road
Newburgh, Ind. 47630

Bulletin Boards - Examples

Special Net -
National Association of State Directors of Special Education
2021 K. Street, NW, Suite 315
Washington, D.C. 20006
202-296-1800 - See Appendix II

Hex
11523 Charlton Drive
Silver Spring, Mo 20902
301-593-7033 Computer
301-681-7372 Voice

Mesa High Jackrabbits
call 602-926-1325

Compuserve
Starter Pack available from local software vendor

The Source
1616 Anderson Road
McLean, VA 22102
703-734-7500

Hundreds of other bulletin boards both commercial and public can be found in the directories listed on page 8.

Buyers Guides or Directories

The addresses and costs are listed below:

The Buyers Guide to Modems and Communications Software
Teny C. Silveria, Sanjiva K. Nath, Edward Hogg,
Tab Books

Omni On Line Database Directory
Mae Millar Publishing Co.
866 Third Ave.
New York, NY 10022
ISBN: 0-02-079910-1

The Computer Phone Book
New American Library, Inc.
1633 Broadway
New York, NY 10019
ISBN: 0-452-25446-9

Electronic Universities

Receiving college credit via telecommunications is already a reality. A San Francisco firm, Telelearning, offers over 170 courses. Students purchase a knowledge module containing modem and communication software and then receive a course catalog. Costs vary from $8 for a seminar to $275 for a 3 hour graduate class plus. Call 800-20-Learn or in California call 800-44-Learn.

Bibliography

Anderson, "Telecommunication Talk", Creative Computing, Vol. 11, Number 3, March 1985, pg. 22

Bartime, Jim, "Should You Try Banking By Computer?", Personal Computing, Vol. 9, Number 11, Nov. 1985, pg. 61
"Credit Union Consortium Proves Successful", Online Today, Vol. 4, Number 12, pg. 27.

Darling, Sharon, "The Electronic University", Compute, Vol. 7, Number 9, Sept. 1985, pg. 30

Ferraini, Elizabeth, "On the Menu," Linkup, March 1986, pp 5 & 27

Gelman, Joe, "Trouble shooting - How to Avoid the Hassles of Telecomputing," Family Computing, June 1985, pp. 18-21

Jarnschigg, John, "The Conference Cafe - Teleconferenceing is the Nicest Way to Hold a Meeting, Talk it Over, Get Together!", Family Computing, June 1985, pp. 20-22

The Journal viz, Telecommunications Issue, Number 8, April, 1985

Kortum, Sarah, "A Man, A Woman, and A Modem," Family Computing, November, 1984, pp 24-28

Kruger, Anne, "Telecomputing - Exploring On Line Data Bases," Family Computing, Sept. 1985, pp. 14-16.

Levitan, Arlan, "In Pursuit of Lower Phone Bills, Compute!", Dec 1985, pg. 129.

Levitan, Arian. "Telecomputing Today," Compute, April 1985, pp 95, 98

Levitan, Orlan R., "Telecomputing Today: Saving Money with E-Mail". Compute, Vol. 7 Number 7, July 1985, pg. 88

Lockwood, Russ, "Telecommunications", At, Vol. 3, Issue 10, Oct. 1985, pg. 103

Lockwood, Russ, "Tracking the Affordable Home Service," A+, April 1985, pp. 53-56

Mangnin, Ed. "Getting Hooked on Data Communications." Nibble Magazine, March, 1984, pp 110-111

Morabito, Margaret, "Homelink," Linkup, March 1986, pp 10 & 23

Moss, Carol. "The Electronic University" Volume 1 #3 Link-Up, Sept. 1984

Pantiel, Mindy and Becky Peterson. "Computer Jobs: Where, What, How Much." Family Computing, April, 1984, p. 49

Sims, Robert. "Home Telecommunications," Computers Gazette, May, 1984, pp 95-96

Schulman, Roger. "Tele Learning-The Computer Brings the Classroom Home," Family Computing, Sept. 1984 Volume 2 #9

Slatta, Richard, "Telecomputing - Telecommunications Books - On Lie Tour Guide," Family Computing, Aug. 1985, pp. 16-18

Springer, P. Gregory. "Choosing Your First Bulletin Board," Family Computing, Aug. 1984, pp 31-32

Sullivan, Nick, "Buyers Guide to Modems," Family Computing, Jan. 1986, pp 46-49

Sullivan, Nick, "Get a New Kind of Charge with Your Modem and Credit Card," Family Computing, Feb 1986, pp 14-16

Sullivan, Nick, "Telecomputing," Family Computing, Dec. 1985, pp 19, 23

"T is for Telecommunications," Popular Computing, July 1984, pp 105-163

Taber, Florence, "Computerized Bulleting Boards," Microcomputers in Special Education, p 69

"Teletellers, Money, Modems," Softalk, March 1984, pp 83-84

Wollman, Jane, "A No-Hassle Way to Shop?" Family Computing, Dec. 1983, pp 55-57

APPENDIX III

SpecialNet BULLETIN BOARDS

Following is a current list of *SpecialNet* Bulletin Boards and the *SpecialNet* username of the manager for each of the boards.

BULLETIN BOARD	MANAGER'S USER NAME	MANAGER'S NAME
ASHA.UPDATE	ASHA	Stan Dublinske
ASSESSMENT	NSMI	Linda Gibbs
ASSISTIVEDEVICE	PRC	Carol Vagnini
BILINGUAL	UTA.SE	Louesa Polyzoi
CEC.NEWS	CEC.RESTON	Lynn Smarte
CHAIN	OHCHAIN	Margaret Burley
COMPUTER	TURNKEY	Alfred J. Morin
CONFERENCE	NSMI	Linda Gibbs
CONSULTANT	NSMI	Linda Gibbs
C.SET	AZSTATE	JoLene Ralston
CSPD	COUNTERPOINT	Judy Smith-Davis
DEAFNESS	NTID.UR	Ken Nash & Michael Wech
EARLYCHILDHOOD	UOFI	Dale Gentry
EMPLOYMENT	NSMI	Linda Gibbs
EXCHANGE	NSMI	Linda Gibbs
FEDERAL	NASDSE	William Schipper & Sharon Walsh
GIFTED	COUNTERPOINT	Gayle H. Gear (As of 7/15/85)
LINC.UP	LINC	Chuck Lynd
LITIGATION	RIGHT.TO.ED	Linda O'Connor
MARKET	NSMI	Robert McCarthy
MULTIHANDICAPPED	TRD & APT	Bob Olsen, Bruce Bull; Laurie Rovin
NAPSEC.ISSUES	NAPSEC	Susan Nelson
NARIC.REPORT	NARIC	Mary Ragan
NASP	NASP.CTASP	Steve Henry & Tom Hartshorne
NCAH.NEWS	NCAH	Doug Herbert
OPINIONS	NSMI	Linda Gibbs
POLICY	NASDSE	William Schipper
PRACTICES	COUNTERPOINT	Judy Smith-Davis
PROGRAM.EVAL	MSRRC	Christy Ann Riffle
RFP	NSMI	Linda Gibbs
RURAL	ACRES	Phebe Schwartz
RURAL.RESEARCH	ACRES	Phebe Schwartz, Bonnie McGregor
SOFTWARE	MEAN	Alfred J. Morin
SPEC.PE	PROJECT.CSPDPE	Ernest Bundschuh, Shirley Crowley
TECH.LINE	TECH.CENTER	Susan Elting, Sharon Raimondi
TECH.TALK	TECH.CENTER	Susan Elting, Sharon Raimondi
TELEVISION	COUNTERPOINT	Judy Smith-Davis
TRANSITION	NET.UW	Eugene Edgar
VISION	FIMCVH	Paul J. Lewis
VOCED	MISSOURILINC	Mike Stromme

SpecialNet users can access any of the bulletin boards by typing the following at the Command? prompt:

EXAMPLE:

```
COMMAND?  CHECK LITIGATION       <Press Return>
COMMAND?  SCAN SINCE 5/30/85  <Press Return>
COMMAND?  READ 1                 <Press Return>
```

TELECOMMUNICATIONS:

A NEW HORIZON FOR THE HANDICAPPED

I. Overview of telecommunication - What it is.
  A. Scope of telecommunications
  B. Applications
    1. Shopping at home
    2. On-line banking
    3. Learning electronically (Tele-learning) - case study

II. What it Offers
  A. Computer related job opportunities
  B. Social aspects of telecommunications
  C. Academic impact
  D. Mesa High Bulletin Board - case study

III. What is needed to get started
  A. Hardware and software needed
    1. Equipment
    2. Costs

IV. Implementing Technology in an Educational Setting:
  A. Administrative implications
  B. Inservice needs
  C. Funding - how to get it - where to get it

V. Problems and solutions in using telecommunications and electronic bulletin boards
  A. Programs
  B. Equipment
  C. System difficulties

VI. Listing of Resources

A. Communication software

B. Bulletin boards

C. Buyers guides

D. Electronic universities

E. Bibliography

F. Special Net Bulletin Boards

Developing A Writing Lab For Older Disabled Students: Beyond Bank Street

Farah Fisher
Los Angeles Harbor College
Wilmington, California

One of the hottest topics in secondary and postsecondary education today is the students' general lack of writing skills. People speak of 'the good old days' and 'getting back to basics'. High school students must write to receive a diploma. Several colleges have instituted a mandatory writing test before graduation. UCLA has sponsored work in 'Writing across the Curriculum', in which community college instructors in all disciplines are encouraged to give writing assignments.

What happens to students with language deficits in this tide of change? Learning disabled students, deaf students, many individuals have very specific problems with written language. With increased emphasis on writing, the difficulties of these students are magnified. Another policy change is making help in this area even harder. Colleges are moving toward mandatory entrance examinations, many of which include writing. This type of requirement means that programs currently in place that are designated as 'remedial' may no longer be funded. After all, if entrance exams eliminate the students that used to need extra help, then the programs should no longer be needed. Right?

Obviously wrong, at least for students with language problems. The past efforts of many schools to provide separate classes for LD and deaf students may not remain in force. The norm will probably become 'support services', with students enrolled in regular classes. Without proper help, many disabled students will not survive academically. Even students with physical disabilities and no accompanying language problem will need a writing environment consistent with their physical capabilities. A 'writing lab' environment may be one solution to this problem.

There are obvious advantages for the use of word processing over typing or long-hand as a writing medium. The ease of entry from the keyboard, alternate forms of entry (speech recognition for example), 'cut and paste' editing, spelling checks, and grammar checks dictate the use of microcomputer and/or terminal equipment in a writing lab. There are some disadvantages as well, however. The software must be carefully chosen for ease of use and flexibility. For example, a word processing program that does not underline is of little use to a college student writing a paper with a bibliography. All parts of the software and hardware must be compatible. A spelling check program lists the specific programs it may be used with; documents produced by others will need to be checked in a different way. Speech synthesis/recognition devices do not work with all programs.

The question of training cannot be ignored when choosing computers and programs for a writing lab setting. Tutors, staff, and students all need to feel comfortable with the lab set up. Someone must be responsible for training students new to the system. Tutors and/or instructors will necessarily be familiar with written composition techniques, but may have some resistance to using a computer as an aid. Though it is certainly possible to divide staff into 'writing people' and 'computer people', it is not to the student's advantage to do so.

A writing lab, then, should provide word processing equipment (adapted as necessary), programs for typing, editing, spelling and grammar checks, and assistants trained in the teaching of written composition, computer use, and the special needs of students with language deficits. Ideally, the computer's potential should be used to the fullest with computer-assisted writing instruction. It would be helpful to include instruction in keyboarding skills as well as standard forms for resumes, etc. The picture seems like an impossible dream.

The good news is that many campuses already have most of the elements needed for this ideal lab. Virtually every college campus in the state has at least some computer access for its students. Many have microcomputers in a lab or library setting with accompanying word processing software. A large percentage of DSP&S programs have computers in their facilities or access to 'reserved' equipment in a campus lab. Spelling checks and, less commonly, grammar checks are sometimes available. Adaptive devices are often found only on campuses with a higher number of physically disabled students, but these are usually not required for the language deficient student.

The problem of staff training still exists. Campuses can generally provide a pool of students qualified to help with computer use, but it would take effort and time to train them in the teaching of writing. How much computer knowledge does it really take to run a microcomputer? About all anyone has to know is where and how to put in the disk and a method for 'booting' (starting) the program. This is usually as simple as putting in a disk and turning on the computer. The staff members who are trained in aiding special needs students with writing can learn these techniques in a very short time. They must also learn to use the particular programs that are available to students in the lab. Some workshops and guided practice sessions given by those on campus who already use the program would suffice. Technical help may be needed during the installation of the hardware and software, and should be available by phone for troubleshooting as the lab is used.

The remaining elements are any adaptive devices that are required for the disable student population, and purchase of any software that is not already available on campus. It is essential that all the hardware and software can physically work together. There are differences in operating systems, memory size, type of document file storage, and model of computer. The work processing program should be as easy as possible to use, but have enough power to complete the requirements of a college writing assignment.

Another consideration is the screen display. Color monitors are wonderful for any computer-assisted instruction programs, but can distort letter images in word processing if the letters are small (80 column display). If a word processing program displays only 40 characters across the screen (less than the usual width of a page), the student will not be able to really judge the appearance of the document before printing. Adaptive devices like speech synthesizers may require specially written word processing programs, and these are not always compatible with the spelling/grammar check programs. It is best to thoroughly research the use of adaptive devices.

Computer-assisted writing instruction and/or aids may be useful. One such program is HBJ Writer from Harcourt Brace Jovanovich. It was originally developed at UCLA for the Freshman Writing Program. Then called WANDAH, students used terminals to write English compositions. It is now available for the IBM PC (256K, 2 floppy drives) and is being adapted for the APPLE. The program does not really give instruction in writing, but rather serves as a guide and word processor.

There are three sections to HBJ Writer--Prewriting, Word Processing, and Revise/Review. The table below shows the functions in more detail.

PREWRITING

Free writing - Student types 150 words about anything. If he/she stops for more than a second, the computer beeps.

Nutshelling - Student enters title, purpose, audience, and summary of proposed paper.

Planning - Student must supply a working title, thesis statement, and supporting and opposing statements. These ideas are limitd to seven words or less, and the student arranges them in the desired order.

Invisible writing - Student types 100 words that do not appear on the screen. This forces concentration.

WORD PROCESSING

Similar to many other word processors. Several Keys on the Keyboard are 're-defined' (used for purposes other than marked on the Key). This is confusing, but a template is provided to aid the student in remembering.

REVISE/REVIEW

Nutshell - Student again enters title, purpose, audience, and summary. Windows can be used to compare this nutshell with the prewriting exercise or the actual paper.

Transition & pronoun search - A printed summary of the number of pronouns and transition words used.

Sentence outline - Constructed from the first sentence in each paragraph or selected sentences.

Stylistic review - Counts 'BE' verbs, prepositions, abstract words, 'tion'/'sion' words, gender-specific nouns. Includes sentence and paragraph length.

Mechanical review - word usage (highlights words that often cause difficulty), punctuation (matching pairs of () and "", question words not followed by ?, period after salutations), spelling.

Comments - Others can read the paper and leave comments for the author. The advantage of HBJ Writer is that it provides guidance to students who need structure, and gives written analyses that may be helpful to the instructor. A disadvantage is that its word processor is not the most convenient available.

For campuses with APPLE equipment, Appleworks, Sensible Speller, and Sensible Grammar make a nice package for a writing lab. Appleworks require 128k of memory, and all three programs are more convenient with two disk drives. They run under ProDOS and are set up for the APPLE IIe/IIc keyboard. Appleworks is powerful enough for any college paper, but is very easy to use. A simple tutorial is available. Sensible Speller is very similar to Bank Street Speller, checking all words in a document against a dictionary file, then printing lists of word usage and possible incorrect spellings. Suggested spellings are available. Sensible Grammar checks for punctuation errors (spacing around ():,-";), looks for cliches, expands contractions, finds duplicated words and a few misspellings (like 'irregardless'). Legal terms can be removed, and pompous and sexist phrases replaced. As with any checking program, it is limited by the lists of these phrases kept on file.

What about the ever popular Bank Street Writer and Speller? Though they are readily available in many DSP&S programs, they do not really meet the demands of secondary/postsecondary writing. Using the older versions, capitalizing is difficult. Newer versions take advantage of the SHIFT key, but do not really underline. Students cannot see what the document will actually look like before printing in all but the 128K version. The Speller marks as possible misspellings any words commonly used at senior high school and college level, since they are not found in the dictionary file. It is not an appropriate tool for older writers.

In summary, older students with language deficits need some very special help. Given equipment and useful software, the computer can be of great help to the writing teacher.

Reducing The Anxiety In Computer Training

Farah Fisher
Los Angeles Harbor College
Wilmington, California

Recent technological advances have changed the computer's role from an interesting toy to an essential part of education and the work environment for many disabled individuals. As its use increases, the demand for appropriate computer training also grows. It is essential that the training is well-designed and presented.

Though the computer is almost universally touted as beneficial for the disabled, it can never reach its potential for help unless proper training is provided for its users. As with anything new, some apprehension is expected as people approach unfamiliar machinery for the first time. Wondering how to set margins on a new typewriter, the battery connections on a new wheelchair, how to check the oil or change a tire on a new car--most individuals have experienced some of these situations. Even though apprehension is normal in unfamiliar situations, computer anxiety may go deeper.

Computer anxiety may be viewed in several ways. It may be seen as resistance to innovation, a variety of 'state' anxiety similar to math anxiety, or a totally unique entity. The lack of clarity in its definition makes research in this area of anxiety reduction difficult.

If computer anxiety is merely resistance to innovation, then it is not truly anxiety. Earlier studies involving the acceptance of instructional television in the schools show that certain types of people are more likely to accept innovation--more educated, younger, more professionally oriented, and with previous innovation experience. To reduce anxiety using this model of computer anxiety, personalities would have to change!

The view of computer anxiety as a type of 'state' anxiety is more useful when examining methods of easing apprehension concerning computer use. A good deal of work has been done recently in the reduction of math anxiety (For example, see Tobias, 1978). Several recent studies have associated computer anxiety with math anxiety. Such a relationship implies that the less math included in computer training, the lower the amount of anxiety incurred by the training.

Computer anxiety has some unique elements as well. There is a mystique about computers in general use that may pervade educational computer use. Many people have had negative experiences that were, directly or indirectly, related to computers. An outrageous phone bill, an incorrect bank balance, piles of "Dear (insert name)" letters, movies about malevolent machines--all of these events give computers a negative image. It is difficult to view the same machine as beneficial and dangerous at the same time. Reduction of anxiety, assuming this paradigm, implies that a better general understanding of computers is necessary for a greater acceptance of their use in education.

What, then, can be done about this confusing problem? Since the user's personalities and the computer hardware cannot be easily changed, the obvious answer is the adaptation of the training content and methods.

There are some clear limitations on the flexibility of the content. A training course for teachers, for example, cannot be taught solely by allowing participants to play games. But is programming really necessary? How about binary arithmetic? The content must be broad enough so that all participants have at least a minimal understanding of the process of running a program and some minor troubleshooting ability. When training most people in microcomputer use these days, disk handling and turning on the equipment are almost all that may be necessary. Students with cognitive disabilities may need more extensive training, but instructional adaptation is second nature to special education personnel. The physically disabled may need extra practice in the use of any adaptive equipment. The most important factor in choosing content for computer training is its scope--it must include all necessary information, but most not overwhelm the participants.

I have found from personal experience that 'de-mystification' is an important step in anxiety reduction. Even though it is not essential to memorize hardware terminology in order to use a computer in teaching/learning, I always begin by opening up a microcomputer and explaining the purpose of the boards inside. I pass around a chip and an interface board and allow everyone to touch the insides of the computer. A computer glossary with definitions written in simple language is always a part of the handouts. Whenever possible, comparisons are made between human and machine 'input/output' devices. By eliminating some of the mysterious black box image that computers have, at least one source of anxiety is eliminated or diminished.

The methods used in computer training are, of course, extremely important in reducing anxiety. Years of psychological research have shown the value of such methods as desensitization, relaxation training, modeling, and stress inoculation (Kutash et al, 1980). These techniques are usually reserved for very specific situations in which the purpose of the training is to reduce anxiety. This type of concern is secondary, though necessary, in computer training.

There are some lessons to be learned from this research that apply to computer training. Small groups are best for an intimate feeling. It is important that participants be encouraged to ask questions at any time, so that any negatives can be quickly dispelled. The small group setting makes this easier. I have found that making mistakes (on purpose) is a good way to reduce apprehension. This is a type of 'modeling', demonstrating that when things go wrong, it is not necessary to panic. When individuals are anxious about breaking the machinery or damaging disks, they are generally relieved to see that nothing terrible happens.

Humor is an excellent aid in relaxing the audience; not simple jokes, but humor aimed at technology. The use of humor reduces stress partly because it allows us to communicate ideas that might otherwise be considered distressing or 'incorrect' (Lefcourt & Martin, 1986). I keep a collection of computer-related cartoons to pass around or to examine during breaks. People can laugh at others' mistaken attitudes about computers and perhaps change their own at the same time.

The nature of the audience can effect both the content and the method of presentation. For minimum anxiety provocation, the audience should be as homogeneous as possible. Mixing older and younger students, or teachers, students, and administrators in the same audience is bound to create negative situations. Simple questions from one group with more knowledge may create negative situations. Simple questions from one group with more knowledge may create anxiety for beginners.

When training teachers, I almost always include a hands-on exercise to be completed on their own after the workshop. These activities are always very specific, including instructions on which key to press at any given time. This way people can work without the pressure of time and with no one around to see their mistakes. Whenever possible, individual follow-up assistance is offered by the presenter on an on-call basis. As people have questions or problems, the presenter (or a designated person) will give help by phone or in person. This model of training has proved to be extremely helpful in reducing anxiety.

One of the most important factors is also one of the most obvious--the presenter must feel comfortable with the equipment and material being presented. If he/she is a novice in the use of the equipment, then the necessary depth of understanding to correctly interpret questions cannot be reached. The presenter must also know the software well enough to realize what information is essential and which should be left for an advanced session.

Most of the concerns and methods expressed above are based on common sense. If we employ good teaching methods (as we currently do or previously did in special education settings), then we should be able to make computer training a pleasant situation. The most important thing to remember is your own feelings when you first began to learn about computers. With that in mind, computers can someday reach their full potential for usefulness with disabled individuals.

REFERENCES

Kutash, I., Schlesinger, L., & Associates, Handbook on Stress and Anxiety. San Francisco: Jossey-Bass Publishers, 1980.

Lefcourt, H. & Martin, R., Humor and Life Stress New York: Springer-Verlag, 1986.

Tobias, S., Overcoming Math Anxiety. Boston: Houghton Mifflin, 1978.

The Computer Access Project: A Program Model For Vocational Training and Placement For Individuals With Moderate To Severe Cerebral Palsy

Susan Fleischmann
United Cerebral Palsy
Oakland, California

Abstract

The Computer Access Project is a specialized vocational training program implemented in September, 1985, by United Cerebral Palsy (UCP) of Alameda-Contra Costa Counties in Oakland, California. This paper describes the design and implementation of this model of vocational training. The model utilizes advances in rehabilitation engineering and computer technology to enable individuals, who were thought to be unemployable, to acquire competitive job skills. Ten individuals completed an eight month classroom curriculum: five individuals learned computer aided drafting and five learned bookkeeping using the personal computer. This project is the first one of its kind to focus specifically on the competitive employment of individuals with severe physical disabilities.

Why This Project?

Why UCP's Involvement?

United Cerebral Palsy of Alameda-Contra Costa Counties conducted a needs survey among over 1,000 individuals with cerebral palsy: the Number One need was for employment training and job placement. Perhaps the major reason why this particular UCP affiliate started the employment training program is its geographic proximity to Berkeley, California where a large number of people with severe disabilities have settled because of Berkeley's architectural accessibility and its relative abundance of services to this population.

UCP's average client has been unemployed for 10 years. The two major factors which have contributed to their seeming unemployability are: 1) the severity and complexity of their disabilities and 2) their lack of job skills and job related skills, which is the result of little or no appropriate training. All of our clients have been closed cases of the State Department of Rehabilitation as "unable to rehabilitate."

This author has had a good deal of exposure to other programs for individuals with cerebral palsy throughout the United States because she was employed by the national organization of UCPA for several years. The problem of the seeming unemployability of individuals of at least average intelligence with severe physical limitations is not limited to the San Francisco Bay Area, where perhaps it is more pressing because of the large population of individuals who are both disabled and unemployed. Every affiliate of UCP sees this as a major problem with no real solutions available to them although everyone is aware of the microcomputer revolution and how this revolution can assist people with disabilities: Computers have assisted in the areas of communication and special education. Employment training still seems to be an area that has been explored very little for very good reasons: Computer equipment and engineering adaptations are very expensive; the rehabilitation engineering expertise isn't always available; training classes are long for this population and rich in staff/student ratio, which is also expensive. The California Department of Rehabilitation is very much oriented towards funding short-term (3 to 6 months) and inexpensive training programs ($1,000 per training).

The Program Model

A formal market survey was not done to determine what training classes to offer. Staff interviewed several professionals in rehabilitation and high technology.* From information that was gathered, it was decided to provide a training course in two areas of software applications. These two areas were chosen for three reasons: 1) speed is not a major factor in performing work tasks, 2) there is a growing job market for both jobs, 3) these jobs are white collar but not professional jobs so that college degrees are not a requirement. Therefore, this expands the client population which can be accepted into the training program. There were several practical considerations and restrictions which determined the design of the training course. Two of the major determining factors were the limited number of computers available and limitations in classroom space.

UCP received $67,500 from the State Department of Development Services Program Development Fund to implement the employment training program called the Computer Access Project. The target population was intelligent, moderately to severely disabled individuals with cerebral palsy. The program began in September, 1985, with the hiring of a project coordinator whose first task was to procure computer hardware and software since no funds had been allocated for this in the PDF grant. The coordinator accomplished this task very effectively. She was able to get up-to-date equipment donated directly from the manufacturers. Six IBM compatible machines were donated plus all necessary software. Six machines limited the class size to six students. Funds were unavailable to rent more space so

---

Note. The local Administration for the Department of Rehabilitation. The President of a small software design company that uses CAD. Several CPA's working for both large and small accounting firms. Computer Aided Design and Bookkeeping using the personal computer.

the UCP conference room and two small adjoining offices (338 square feet) were converted into a classroom which could accommodate six wheelchairs.

We spent a great deal of time making the machines work with the software and adaptive peripherals. The project owns only two IBM machines. The other four are compatibles which we discovered were not as compatible as they could have been. For example, an Apricot Computer was donated that has a 3 1/2" disk drive. It runs the CAD software but materials can't be transferred to the other machines which have 5 1/4" disk drives. We also bought and returned two IBM "clones" because we were unable to use a piece of software called Keylock with them. This software is necessary to increase date entry speed. If we had the choice we could obtain only IBM machines.

Because of the number of computers available to us, the curriculum model was designed as two classes of three hours each meeting, 5 days a week. The CAD class met in the mornings and the bookkeeping class met in the afternoons. The PDF grant primarily funded staff positions. We were very fortunate to hire an architect who had experience in teaching CAD to teach our CAD class. The staff also consisted of a classroom aide who was a drafting student. The bookkeeping class was taught by a bookkeeper who has had experience in working with people who have severe disabilities and the bookkeeping aide who was a computer science student who helped up when there were software problems.

The teachers designed their own curriculum which was somewhat modified to accommodate the anticipated slowness of the students. It turned out that the bookkeeping class had to be slowed down even more, primarily because of the severe physical disabilities of the students.

The CAD curriculum was accelerated because the teacher discovered that because the students were "computer literate" they learned the material more quickly than her non-disabled students who were architects and draftspersons and tended to be more "computerphobic" than the disabled students.

The classroom training began in January, 1986, and was scheduled to end in August. It was expected that 11 students need at least a B grade to graduate from the course. One person dropped out due to lack of interest and one person will not pass. All other students will graduate with a B grade or better.

Assessment of Trainees

The project was very successful in selecting trainees who would be able to complete the training course. The application process consisted of two personal interviews; the submission of a short written essay explaining why the individual was interested in entering the program; the completion of aptitude tests to determine which training class would be most appropriate for the individual student; the submission of two written application forms giving personal and work history and a recent I.Q. score. The aptitude test for the drafting course was called The revised Minnesota Paper From Board Test. The bookkeeping test was procured from a temporary employment agency which administered this test to potential temporary employees. Both tests seemed to give an accurate indication of the trainees' potential to perform the work. We did have one student who received a very low score on the drafting test and turned out to be the best student in the class. Motivation played a large role in his classroom success.

One of the major criteria that the staff looked for in accepting students was their motivation. All students exhibited very high motivation to work hard in the classroom in order t gain skills so they could be employed. Another important factor in their success in the classroom was their excellent social skills. Individuals were not accepted if they exhibited socially inappropriate behavior. The basic students profile is a highly motivated socially skilled intelligent person who has some background in working with personal computers. No one in this initial class was totally "computer illiterate." We admit to "creaming" the selection of this class because the project needed a high rate in order to convince funding sources to provide on-going funding.

Adaptations of Hardware and Software

Listed below are adaptations made for each of the students who needed them. Many of the adaptations were recommended and designed by the Rehabilitation Engineering Center at the Children's Hospital at Stanford. Approximately $7,000 of the PDF grant was designated for rehabilitation engineering design and consultation. An initial work-site evaluation was done for each student. An engineer and an occupational therapist came to the classroom and assessed the students' speed in accessing the computer keyboard and their seating and positioning as it related to their speed and accuracy on the keyboard. Work stations were designed for each individual according to the recommendations of the Rehabilitation Engineering professionals. Many of the other adaptations were done by volunteers so the project did not utilize all the funds allocated for engineering consultation.

Tom: Tom uses a headstick to access a membrane key communication device called AutoCom. A K-11 interface manufactured by Prentke-Romich was used with a special cable to hook the AutoCom keyboard to the IBM PC so that Tom could make full use of the computer. The adaptation made for Tom was the most technically difficult because it involved reprogramming his electronic communication device so it could perform all the functions of an IBM keyboard. Tom also uses software called Superkey to develop macros to minimize the number of keystrokes entered for use with the bookkeeping software.

Maria: Maria uses a simple keyguard manufactured by Prentke-Romich. She has a special Stanford Seat Insert which has helped her posture so that she tires much less easily an is able to work more quickly. Maria has athetoid cerebral palsy and her excess movement was causing her to kick the electronic plug out of its socket, thus disconnecting her computer. A plate was designed to fit over the socket, which solved the problem. Maria also uses the Superkey software.

Adele: She also uses the Superkey, which is a piece of commercially available software which was recommended by the engineer from Children's Hospital at Stanford. Adele used an Epson Speech Pac as a communication device. She was very unhappy with the quality of the voice and therefore rarely used the device, which had been purchased for her at great expense by the Department of Rehabilitation well before she entered the Computer Access Project. A DecTalk speech synthesizer was purchased for the project through a grant from the Digital Equipment Corporation and the Pacific Telesis Foundation.

This is a commercially available product which has excellent-quality voice output. It allows Adele to use a clearly understood female voice to communicate. The staff is working with volunteers to attach the DecTalk to Adele's wheelchair so that she can utilize it outside the classroom. The Toshiba T-1100 computer interfaces with the DecTalk and allows for storage of almost unlimited vocabulary and conversations. A volunteer from the U.S. Air Force who is stationed at the Lawrence Livermore Lab is in the process of writing a software program for the Toshiba to interface with the DecTalk. Phrases are being stored so that with one keystroke Adele can speak a whole phrase.

Tim: He uses the Keyport 300 initially. It is similar to a Koala Pad: It has a membrane surface. Tim was able to program it to perform several functions with the use of one keystroke. Tim has learned AutoLISP which is the programming language of the CAD software being used. He now designs macros directly on the keyboard and no longer needs the Keyport.

Description of the Commercially Available Software Used in the Classroom

The AutoCAD software allows people who have never been able to draw to make accurate drawings. It allows individual users to customize the program to meet individual needs. AutoCAD is the most widely used CAD program among architects, engineers and manufacturers.

Easy Business Systems Plus is an accounting software package designed by Computer Associates. Its modules include general ledger, accounts payable and receivable, time billing and a "windowing" program which allows quick transferring of information to other modules.

Students also use two other pieces of software: Sidekick and MindReader. Sidekick can be used for note taking and arithmetic. The MindReader is a word processing program which allows the user to type whole phrases with just one keystroke.

The student in the bookkeeping class use Accutype, an electronic copyholder which allows them to scroll their work sheets using a foot or hand peddle.

The Business Advisory Committee

The second major task of the Project Coordinator after she began her work with the CAP was to organize a Business Advisory Committee which would have a commitment to help establish the Computer Access Project. The BAC has assisted with hardware and software donations and provided many hours of free technical assistance. The BAC members primarily work in the high technology industry. Without their assistance the project would not have been able to get the computer equipment that was needed. Presently the BAC is helping plan a strategy to start two small sub-contract businesses. A business plan is being written with their help.

Client Profiles

The Project started by accepting 12 students into the program. Unfortunately one student died before the program began and another dropped out halfway through the course, leaving us with 10 students. It was decided not to accept other people from the waiting list because the smaller the size of the initial class, the better we could teach the material on an individualized basis. Of the ten students in the two classes, six are electric wheelchair users and two are ambulatory with the use of cane and crutches. Three trainees are non-oral. All but two have varying degrees of speech impairment. Two use headsticks and one uses a mouthstick to access the computer keyboard. Most of the trainees can type no more than ten words per minute. Two of the trainees have college degrees and the rest have at least completed some community college courses. Everyone is a high school graduate. All students are presently active cases with the State Department of Rehabilitation. Three are active with the local Regional Center. The age range is eighteen to forty. Four live independently with the help of attendants and the rest live with their parents.

Funding Sources: Present and Future

As mentioned UCP received a PDF grant from the State Department of Developmental Services in the amount of $67,500 to start the vocational training portion of the CAP. The project also received $5,000 from the Pacific Bell Foundation, $3,000 from IBM and $1,500 from a small private foundation. This funding paid the salaries of staff and bought some adaptive equipment. It haas also paid for rehabilitation engineering consultation. An IBM computer was purchased with the IBM donation. All other computers were in-kind donations.

Future funding has been partially secured as of this writing. The funding will be used for Phase II of the Project which will begin in October, 1986. Phase II is the Practical Work Experience phase which is described in the following section. CAP has received $50,000 from a large private foundation and $2,500 from a small local foundation. It is anticipated that another $50,000 will be granted from both private and public sources. We anticipate the need for a $100,000 budget for Phase II to cover more of our expenses than were paid for with the PDF grant. The project is looking for on-going funding in FY 87-88 from the State Department of Rehabilitation, Habilitation Services. A proposal has already been submitted and has been provisionally accepted.

Things To Be Done Differently

More research of the market place should have been done before deciding on the training classes to be offered. The two courses of study were selected without thorough research, although they seem to be appropriate for the students' abilities. In the assessment of students' abilities to perform work tasks, the project should have had more BAC volunteers to set up "real work" tests of the students' skills. This has been started near the close of the project but should have been done on an on-going basis. Also we adjusted the teaching schedule of the CAD class to three days per week instead of five days per week in order to be able to afford to pay the architect for her teaching. The class should have had instructional time for the full five days and we plan to change this for our next teaching class.

Another limitation of the project was the need to track students into either bookkeeping or CAD training. If the students wanted training, they had to accept one of these two training options. Because the CAP was "the only game in town" for people with severe multiple disabilities, interested people had fewer options than they would like and that they deserve to have.

This is a problem that will not be solved in the near future because of the economic limitations of this program. We must keep small until we can prove that this is a viable training model.

The Next Step

The vocational training Phase I of the project ended in August. The next step is Phase II: Practical Work Experience. United Cerebral Palsy has received private foundation grants to implement Phase II for FY 86-87 starting on October 1st.

It was originally anticipated that the students would be ready for competitive work after the completion of the 8 month training course. As the training progressed, it became more apparent that the students would need a second phase of training to develop more skills to have an opportunity to obtain work experience. It is increasingly difficult to find an entry level job. With paid work experience on their resumes, those who are capable of entering the competitive job market will be much more likely to find employment. Many of the students will probably stay with the project as employees because of the limitations of their physical disabilities; e.g., slower than average work speed, the inability to easily and clearly use their speech to communicate, and the need for attendant care during working hours. It has been decided that work contracts will be procured during Phase II for both the computer aided drafting and the bookkeeping projects. If the projects can be successful in procuring enough paid work to pay at least minimum wage to most of the employees, the project will attempt to establish two small sub-contract businesses.

The project has funds to hire a Contract Procurement Specialist who will procure paid work for the employees. If the two businesses are established, we don't anticipate being totally for-profit and self-sustaining. Each small business will employ a job supervisor and the bookkeeping business will need a vocational aide to manipulate papers for the employees and help with personal care. It is anticipated that the on-going salaries of the supervisory and support staff will be funded by public monies from the State Department of Rehabilitation, Habilitation Services. All income earned by the business will be paid to the disabled employees. There will be no second training class during FY 86-87. We will evaluate the feasibility of on-the-job training by accepting two more students into each practical work experience program. If on-the-job training is feasible we will no longer offer classroom training. We also would like to expand our client population to include persons with other moderate to severe physical disabilities. The project has set itself an ambitious goal. We feel we have the funding, the staff support, the engineering expertise and the skilled, capable employees which will make this venture a success.

Computer Use As A Tool In Vocational Preparation And Adult Basic Educational Curriculums

Marguerite Harmon and Matthew Frantz
Community Outreach Program For The Deaf
Tucson, Arizona

Abstract

A research and demonstration project involving deaf and hearing impaired persons is completing the final year of a three year process of examining the effects of computer literacy training and basic education on subsequent success in achieving vocational goals. The subject population has been divided into two groups: Workers in transition (operationally defined as persons in the labor force) and students in transition (operationally defined as persons participating in academic programs). Methods which were developed to assist deaf persons in acquiring basic computer operating skills, vocational information and basic education are discussed. These methods include: Indexing of Occupations, Vocational and Educational Screening, Activities Book Outline, Specialized Computer Software and Adapted Computer Software. Each method is described in the context of Adult Basic Education and how the method contributed to achievement of "real world" outcomes.

Project Background

Deaf persons are inadequately prepared to compete in nonservice occupational areas in part due to the pervasive use of computers in these areas and the concomitant lack of preparation of deaf persons in the use of computers in the workplace. Technology in the workplace includes fields which are "high tech" by nature; electronics and such; as well as more common trade and clerical areas such as secretary or auto mechanic. The common denominator is the use of the computer as a tool with the ability to complete the assigned task being predicated upon skill in the use of the computer.

In order to establish the hypotheses which arise from the stated problem some assumptions concerning the employment status, vocational preparation and educational achievement of deaf persons and the employment "market" in the community were made. These assumptions include:

1. The computer has an impact upon employment in various occupational areas for deaf persons to a greater or lesser degree dependent upon the following:
    a. the relevance of that occupation in the employment of the deaf and hearing impaired,
    b. the relevance of the employment growth in that occupation and,
    c. the impact the computer has on the method of performing the job task.
2. The impact of the computer upon occupational areas will vary by degree and can be rated accordingly.
3. The identified limitations of individual deaf and hearing impaired persons can be overcome through an intervention strategy which relates the demands of the computer as a tool to the performance of a specific job and the "deficits of the individual".

This requirement to test assumptions about the impact of computer technology on occupations across industries resulted in the need to develop an indexing of occupations. This index was to be the basis of an interactive model between three "real world" factors and the research/service environment.

The Adult Basic Education program which was developed was an attempt to respond to the interaction of the demands of the local labor market (e.g., use of computers, skills required, education required, etc.) the needs of the deaf (e.g. physical accommodation, academic remediation, etc.) and the anticipated/actual vocational outcome.

This model was the basis for overall program development as well as the criteria upon which individual programs for participants were based. Inclusion in the service delivery process was then based upon commonality of reliance in all three areas, and would be omitted if the activity could not pass this relevance "test".

See Figure 1 (next page)

The first phase of this model was the assessment of local labor market. This was accomplished through an Index Rating System. This system included information based upon individual employer interviews.

Figures 2 and 3 represent the indexing system. The IRF (Index Rating Form) is the raw data collection instrument and the distribution chart represents how the Tucson industry fared in computer use and applicability. The labor market survey system includes a number of employer contact and questionnaire forms. These range in content from standard job analysis concerns to more employer specific information such as current and projected computer use per occupation, growth forecasts and relevance for employment of the deaf. This system established an ongoing database for all labor market/occupational information for the project.

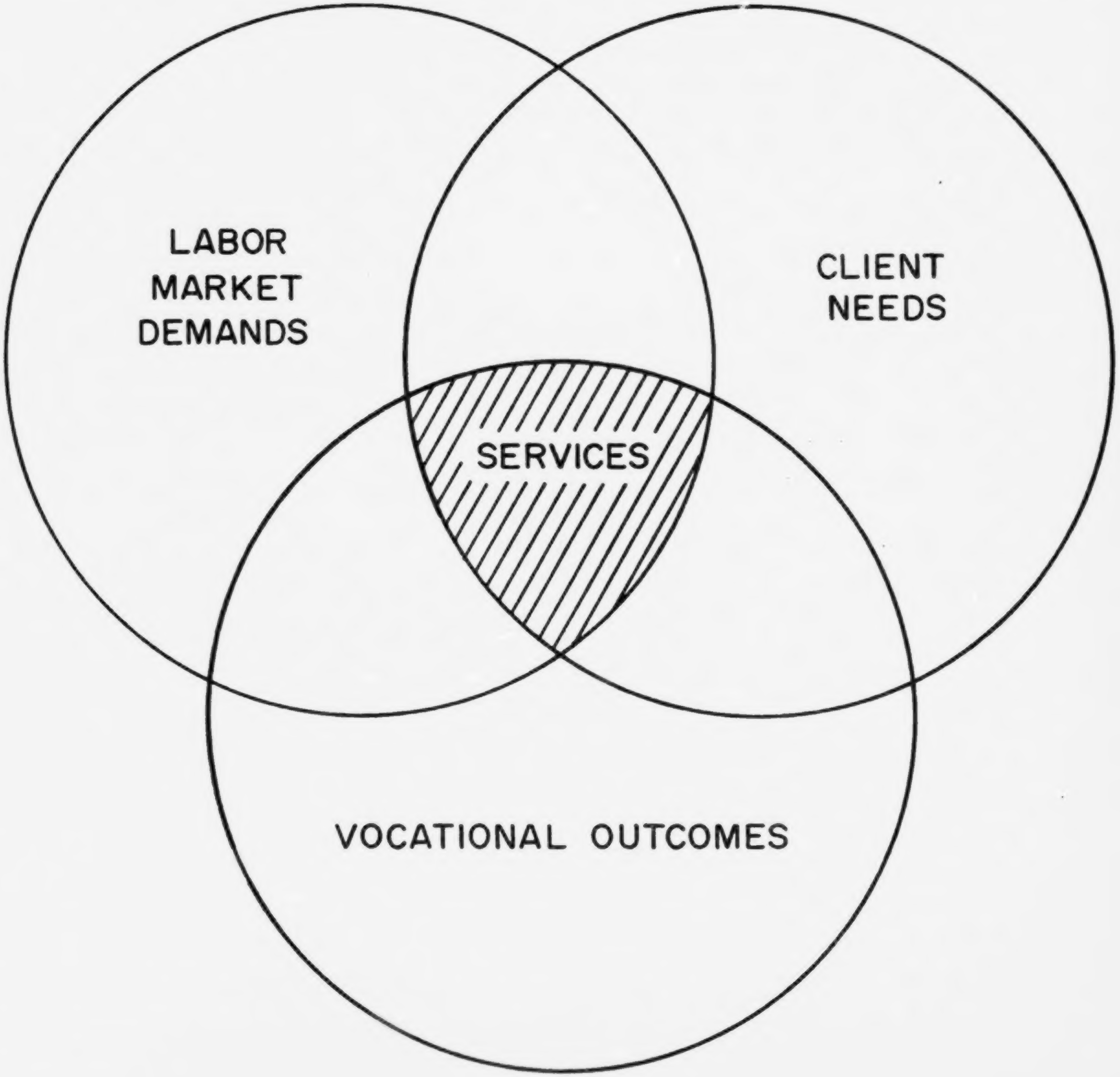

LABOR
MARKET
DEMANDS
CLIENT
NEEDS
SERVICES
VOCATIONAL OUTCOMES

Figure 1

IRF

Employer (from C/E)	Industry Designation	Occupation Area	Occupation Name	Academic Level Required	Computer Usage(1-6)	Applica-bility	Index Rating

NOTES

1. Industry designation from industry chart.
2. Occupation area from page 4 of FP.
3. Computer usage - implementation plans:

1 - minimal	-	slow
2 - minimal	-	moderate
3 - moderate	-	slow
4 - moderate	-	moderate
5 - much	-	slow
6 - much	-	moderate

4. Meets 3 of 3 criteria - A
   2 of 3 - B
   1 of 3 - C
5. Index rating: CU + A = IR

Figure 2

DISTRIBUTION CHART

COMPUTER IMPACT

		1	2	3	4	5	6
APPLICABILITY	A						
	B						
	C						

NOTES

1. Indicates distribution across impact and between relevance catagories.
2. Determine distribution.
3. Tally index rating from IRF.
4. Computer usage - implementation plans:
   - 1 - minimal - slow
   - 2 - minimal - moderate
   - 3 - moderate - slow
   - 4 - moderate - moderate
   - 5 - much - slow
   - 6 - much - moderate
5. Meets 3 of 3 criteria - A
   2 of 3 - B
   1 of 3 - C

Figure 3

With 113 different employers and 279 job profiles, the following assumptions can be inferred:

1. Most employers base educational requirements upon the educational level of the person currently occupying the position. Without exception a high school diploma is assumed.
2. Transition to use of computers in most occupations has been slower than employers projected three years ago.
3. 31% of employers interviewed assume a deaf person cannot perform the functions of their jobs.

For the purposes of this paper, Finding Number One is most important with findings Two and Three having relevance to overall project implications.

Simultaneously with the the Index Rating System being developed, research related to academic achievement for the hearing impaired population and adult basic education was conducted. Generally, adolescents and adults do not perform as well as hearing peers on standardized achievement tests. The Office of Demographic Studies (ODS) at Gallaudet College found in their annual survey of hearing impaired children and youth that only 12% of hearing impaired students graduating from high school programs could read above an 8th grade level (1976). Previous studies using various reading assessments, all reported minimal reading improvement in hearing impaired children from the ages 11 through 18 (Pugh 1946, Goetzinger and Rousey 1959, Aronow and Moskowitz 1963, Furth 1966 and Balow, Fulton and Peploe 1971). For most hearing impaired students, the mean reading level was between the third and fourth grade upon graduation. Recent reports have continued to support these findings. Research by the Office of Demographic Studies found that reading levels on the Standard Achievement Test for the Hearing Impaired plateau between the third and fourth grade level at age 15. In most recent research, the Adult Continuing Education at Gallaudet (1986) reported that the top 1/3 percentile of preparatory students entering Gallaudet College had a mean reading level of 5.2.

Vocabulary and mathematic scores for hearing impaired students were also below hearing peers using standardized achievement tests. The Office of Demographic Studies (1977) reported the average score of a 9 year old hearing impaired child on the vocabulary section of the SAT-HI to be K.1 while the average score for 18 year olds was 2.0. This represented less than 2 years difference between 9 and 18 year old students and an average of 10 years retardation in a 19 year olds' vocabulary development.

Mathematic scores on the SAT-HI tend to level out at the 7th grade for hearing impaired students beginning at age 15. Twenty-five percent of hearing impaired students over 18 can do math beyond the 9th grade.

Research conducted regarding the characteristics of participants in adult basic education (ABE) found that the largest group of individuals served by ABE were between the ages of 20 and 55. About one-third of these participants had completed up to twelve years of schooling (Adler 1984). In assessing the instructional functioning of adult basic education programs, Adler stated that career development was an essential part of adult basic education. Individuals enrolled in ABE programs were described as having specific career development needs related to deficiencies in basic skills, unsatisfying or no vocational experiences, and possible low self-esteem. Research related to career development and hearing impaired adults concluded that few hearing impaired workers had access to extensive and appropriate information, counseling, and guidance in making career choices. Few resources were available to assist in upgrading the skills of unemployed, underemployed, displaced or otherwise terminated hearing impaired workers (Watson, Anderson, Marut, Ouellette, and Ford 1983). A survey of continuing education for deaf consumers in 15 cities, reported that deaf adults had similar needs for continuing education as the hearing population. Deaf consumers ranked improvement of language skills, better management of home, property and money, and increased income through better jobs as their top priorities (Costello, 1977).

Based on information obtained through the literature review, the Index Rating System, and meetings with employers, COPD designed its adult basic education program. The ABE program was operationally defined as a program of services to improve not only academic functioning of hearing impaired persons but also to increase work opportunities, ability to complete, maintain and upgrade work tasks, and provide information that will lead to the ability to further access training or educational options. The ABE program expected hearing impaired persons to have low academic skills in reading, mathematics, and vocabulary. As an agency providing career awareness and job placement, it was anticipated that persons entering the program would have specific career goals. In addition a project goal was to introduce the computer as a tool to present vocational information.

Therefore, the ABE program developed its curriculum to address all of these areas and meet the needs of hearing impaired persons.

The discussion to this point indicates the following hypotheses:

1. A service delivery model which replicates the use of the computer in the workplace will increase participant employability and improve career choice.
2. An instructional model which incorporates the computer as a tool for providing career and computer information will improve acquisition of computer literacy skills.
3. An Adult Basic Education model which will be based upon vocational functioning will improve the acquisition of basic literacy skills.

The project participants were divided into two groups: workers in transition; operationally defined as persons in the labor market and students in transition; operationally defined as persons participating in academic programs.

Although the focus of this paper is the Worker in Transition Group in general, the combined population is composed of 123 persons between the ages of 14 and 66. These persons were predominantly profoundly deaf and used sign language to communicate. For Workers in Transition group, the tested mean academic achievement grade level in reading was 3.6, vocabulary was 3.8, and mathematics was 5.3 Regarding the educational status of this group, 90% of the participants had a high school diploma.

Program Process

As has been mentioned, the project attempted to address several different population needs through an individualized service program.

Before discussing the ABE portion in depth, an overview of the project and materials will be presented.

The initial phase of the project was referral and assessment. In an effort to have a better understanding of each participant, the Prevocational Screening was administered to all prospective persons. The areas reviewed were Job Awareness, Interests, Needs, Work Habits, Daily Living Skills, and Skills and Abilities. This was not meant to be a comprehensive vocational evaluation. The VALPAR Micro-Computer Evaluation and Screening Assessment (MESA) was the primary diagnostic tool. This was coupled with the participant interview, worker rating assessment and job profile.

A specific curriculum for the career awareness and computer literacy (CACL) component of the program was developed. The instructional instrument used for this component was the ACTIVITIES BOOK OUTLINE (ABO). This instrument was used to provide a structured approach to teaching both computer literacy and career exploration in a hands-on fashion.

As the educational programs were implemented, specific instruments were developed and purchased to assist with instructional services within the CACL program. Two instruments, the Index Rating System and the Activities Book Outline, have already been mentioned. The following group of additional instruments listed represents both agency developed systems and modified hardware/software systems: Name That Industry, Name My Occupation and ValSearch Job Bank.

Each CACL model was used with both students in transition (SITS) and the workers in transition (WITS) participants, a total of 79 persons. Each WIT participant in CACL received a 15 week program.

In conjunction with the local community college, CACL was offered as a three credit course and participants were allowed to use the computer lab. Within the program were options for introduction to the computer in technical, clerical, machine and general industrial areas. Participants completed modules such as formatting disks, using a word processor, developing spreadsheets, and exploring career and local labor market information. Certain modules were required for all participants. As they progressed in the course, participants focused on computer exercises related to their career goal.

In the final class posttesting of all participants was completed. A total of 32 persons participated in a three semester time frame with 23 completing all requirements. Posttest results specific to the participant population showed an average increase in test scores of 10 points. Group results on the posttest indicated a 100% increase in the mean score. T-Test for significance of the difference between means on the pre/post test was at the .01 level. The significant innovation of this method was that participants simultaneously gained computer operating skills, local job market data and how this information impacts on their personal career goals. As participants completed the CACL training, each person had an exit interview to discuss how to use the information learned either on the job or to assist with obtaining a job. The Adult Education program, in keeping with the interactive model of services proposed, was based upon labor market environment information from the Index Rating System, individual needs and analysis of specific skills related to work tasks.

ABE Curriculum

As participants entered the ABE program, evaluation data was reviewed to effectively develop an educational plan to address the vocational and educational needs of each person. This information was used to determine appropriate placement in the ABE curriculum.

The curriculum implemented in the ABE program used a multi-modal approach. The prescribed content areas of the curriculum were reading, mathematics, language/writing, and study skills. The organizing elements for the curriculum were vocational needs, academic survival needs and individual interests. These categories represent the primary concern areas for all participants. All materials and procedures were dependent upon these elements. Services were provided in a format that was congruent with a person's hearing loss, mode of communication/language and cultural value system.

In addition to CACL materials, other career software programs were implemented in learning situations. In planning computer activities, the ABE program used an authoring system to design academic and vocational exercises related to a person's specific needs. The authoring system allowed the instructor to develop computerized lessons and be able to control language structures, vocabulary terms and reading levels. Participants were also involved in using the authoring systems to develop lessons and activities for other ABE participants. Several purchased software programs were incorporated into the curriculum. Software programs were used for drill, as tutorial devices and as recreational entertainment.

In conjunction with the computer, text materials, videotapes, materials from employers, simulated work experiences and guests speakers were instructional tools used in the ABE program. Participants were encouraged to bring books, magazines and work related information to class so that specific materials could be incorporated into each person's educational program.

Several evaluation techniques were used in the ABE program. For remedial academic exercises, traditional tests and handouts were used to evaluate participant's progress. Directly related to career areas, activities and evaluation were based on real work behaviors. For example, a person in ABE who was employed completed writing exercises with the assistance of co-workers, completed work evaluations on their own job performance, and presented career information about their occupations to participants seeking employment. Evaluation and feedback on these activities were provided by the ABE instructor, job supervisors and co-workers. At each six week interval, an overall evaluation was completed for all participants. Each person's educational plan was reviewed to assess progress and make any necessary changes.

In the three years of this project, the ABE program served 16 adults. Nine adults were able to participate in the program for a period of six months or longer. As part of the project goal, grade levels and improvement in academic areas were assessed. Academic test results for program participants were:

	Pre-Test Score	Post-test Score
Academic Area	Grade Level	Grade Level
Reading	6.9	8.2
Vocabulary	5.5	6.4
Spelling	5.4	5.7
Mathematics	4.7	6.0

Posttest scores for academic areas indicated improvement of a grade level or higher for reading, vocabulary and mathematics. The average individual gain for each participant was seven-tenths of a grade level for reading and vocabulary, a tenth of a grade level for spelling and eight tenths of a grade level for mathematics. Of added importance were the real world outcomes associated with participants in the ABE program. Of the 16 participants in ABE, 11 were unemployed upon entering the program. Eight participants were able to secure employment during their education program. Six persons also enrolled in a post secondary program to further improve academic skills.

Summary

Both the computer awareness/computer literacy and the adult education program were successful in providing a needed service to the hearing impaired community of Tucson, Arizona. In order for other agencies to replicate services, the following implications need consideration:

1. Awareness of Employers - Specifically the unrealistic educational expectations and unrealistic attitudes toward the capabilities of hearing impaired persons. The Index Rating System and job profiles used in the program assisted in identifying the educational requirements for local jobs. In the majority of occupations the "twelfth grade" high school equivalent far exceeded the necessary educational level to complete the job tasks. Many employers considered hearing impaired persons a risk to their business due to the inability to hear alarms or complete certain job tasks. For the most part, employers were unaware of small adaptations

that would accommodate the hearing impaired person on the job.

2. Localization of Labor Market and Career Information - The information from the Index Rating System and employer contacts helped to identify realistic expectations for hearing impaired persons. The data also assisted in identifying barriers that hearing impaired persons would encounter in the local job market.
3. Educational Improvement - The differences between project improvement in tested achievement and the expected outcome indicated by previous research can be attributed in part to the vocational specific content information and the value of individualized instruction.

References

Adler, E. Adult Basic Education: A Rehabilitation Resource, American Rehabilitation, (April 1984) Vol. X, No. 4.

Annual and Five Year Comprehensive Vocational Education County Plan for Pima and Santa Cruz Counties. Vocational Education Planning Task Force. July 25, 1983.

Bowe, F. "Employment Trends: 1984 and Beyond Where the Jobs Will Be". 1984

Computers for the Disabled. Conference Papers. 1984, pp. 3-7.

Costello, E. Continuing Education for Deaf Adults. American Annals of the Deaf, (February 1977) Vol. 122.

Croft, F. Unpublished Report, April 1986.

Education in Arizona. Arizona Labor Market Newsletter, (June 1984) Vol. VIII, No. 6.

Fennerson, D.A. High Tech/High Touch: Making Good on the Promise.

Jobs in High-Tech Industries. Arizona Labor Market Newsletter, (June 1983) Vol. VII, No. 6.

LaSasso, C. Annotated Bibliography, Gallaudet College 1981.

Moores, D. Educating the Deaf: Psychology, Principles, and Practices. 1978.

Watson, D. et al. Integrating Technology, Human Resources, and Systems to Enhance the Career Development of Deaf People. Arkansas Research and Training Center. 1983.

Computer Aptitude: Learning Disabled Versus Non-Learning Disabled Junior High School Students

J. Dixon Hearne and Mary Poplin
Claremont Graduate School
Claremont, California

Carole Schoneman
Chino Unified School District
Chino, California

Abstract

Despite its growing utility as a creative and self-expressive medium, the computer is rarely accessible for such purposes in the classroom. The professional literature is replete with evidence that computer utilization among the learning disabled (LD) had been primarily a computer-assisted instruction (CAI) approach. This narrow view of the learner as receptor suggests, among other things, that because of their exceptionalities, learning disabled students possess relatively fewer strengths than their non-learning disabled (NLD) peers and less aptitude for such complex and creative tasks as programming. The purpose of the present study was to examine differences in computer aptitude among 56 LD and 56 NLD junior high students. Subjects in each group were administered the Computer Aptitude Literacy, and Interest Profile (CALIP) (Poplin, M. S., Drew, D. E., & Gable, R. S., 1984) and their composite scores were compared. Results indicated no significant difference in scores earned by LD and NLD subjects in this sample, and intra-group score comparisons suggested that no relationship existed between gender and computer aptitude.

The field of learning disabilities, with a focus on exceptionalities, has contributed uniquely to shifting paradigms in education. As educational axioms are being stripped away by a growing body of information about intelligence and brain functions, our views about the learning process and the learner continue to change. Intelligence can no longer be confined to such categorical representations as IQ, according to Howard Gardner (1982; 1983; 1985), whose theory of multiple intelligence calls for a re-examination of our present educational methodology and aims. Advocates for the kind of reform implicit in Gardner's theory stand united in the belief that strengths and talents are the best channels through which the learner may be reached. Because the schools are deficit-driven, however, as Poplin (1984) suggests, individual talents receive only minor attention in the classroom and even less in school-wide planning.

Computer aptitude represents only one of many aspects of human potential commonly overlooked by the schools. While the growing importance of microcomputers in the schools is unquestionable, an entire publication industry has emerged over the past twenty years to deal with controversy over how they can best be used in the education of children who are literally growing up in an information age.

A recent review of the professional literature (Kolich, 1985), revealed that microcomputer application in the schools has been largely a computer-assisted instruction (CAI) enterprise. Patterned after a tradition of drill-and-practice adn tutorial pedagogy, CAI courseware has remained basically a form-to-function approach which has already failed large numbers of the school population, particularly among the learning disabled (LD).

While the computer has been generally viewed as an interactive device (Kolich, 1985), the degrees of interaction range from simple stimulus-response activities, typically reductionistic and learner-passive, to creative and self-expressive activities such as Papert's (1980) Logo programming, where multiple skills and knowledge are integrated. According to Papert (1980), CAI approaches generally reflect a narrow view of the user as receiver, give little or no attention to user potential or the natural knowledge of the child, and neglect other areas of intelligence. Similar arguments in this general disregard for strengths and talents have sprung up in recent research (Gardner, 1984; 1985; Poplin, 1983; 1984; Turkle, 1985), and the entire focus of the cognitive strategies movement of the 1980's has been toward the more holistic concern for *how* individuals learn (Meichenbaum, 1980; Reid & Hresko, 1981; Poplin, 1983; 1984; Torgeson, 1979).

Because CAI approaches are product-oriented, focusing on *what* the child learns rather than *how* the child learns, they are often taken beyond their point of effectiveness in dealing directly with specific learning problems. Research conducted by Kerchner and Kistinger (1984) suggests that a shift from product to process-oriented instruction yields an enhanced picture of learner potential. By combining the process approach to written with microcomputer capabilities, they discovered improvement in both written expression and the subsequent transfer to paper-and-pencil tasks among one group of learning disabled students. Distinguishable from the CAI approach by the absence of imperatives and penalties, the process approach engages present skills, knowledge and strengths and encourages creativity.

Despite their wide range of utility, computers have been used more as teachers than as tools (Papert, 1980; Poplin, Drew & Gable, 1984; Turkle, 1985; Zemke, 1983). When viewed as the expressive medium described by Turkle (1985), the computer becomes an outlet for the natural knowledge and creativity the Paper (1980) suggests might otherwise remain hidden in a mire of competing classroom concerns. Because of the school's preoccupation with the identification of deficits rather than strengths, however, such opportunities are not generally awarded the learning disabled student, typically a passive receptor of information that has been watered down and stretched out (Poplin, 1984).

Only recently, with the development of the *Computer Aptitude, Literacy, and Interest Profile* has research begun to focus on individual strengths and talents as predictors of success at computer-related tasks. Variables within the construct of computer aptitude have been identified at various times as (a) cognitive ability (Hearne & Lasley, 1985; Konvalina, Stephens, & Wileman, 1983; Poplin, & Gable, 1984; Turkle, 1985), (b) cognitive styles (Konvalina, Stephens, & Wileman, 1983; Poplin & Gable, 1984; Turkle, 1985), (c) societal influence on male-female work roles (Poplin, Drew, & Gable, 1984; Turkle, 1985), and (d) education (Konvalina, Stephens, and Wileman, 1983; Poplin, Drew, & Gable, 1984).

Because the CALIP was designed to minimize the need for complex languages skills, it can be used approximately in the investigation of computer aptitude among learning disabled populations. In the absence of any existing evidence to the contrary, the purpose of this study was to test the hypothesis that two groups of junior-high school students, one learning disabled (N = 56) and the other non-learning disabled (N = 56), possess equal or similar computer aptitude, as measured by the CALIP. Further objectives were (a) to determine the relationship between sex and computer aptitude among the learning disabled students in this sample and (b) to determine the relationship between sex and computer aptitude among non-learning disabled subjects in this study.

Method

Two samples were drawn for this study. The first sample consisted of 56 randomly selected junior high school students (28 males and 28 females), representing a metropolitan, predominantly middle-class school district located in the Southern California area. The second sample, drawn from the same school district, consist of 56 randomly chosen junior high school students (28 males and 28 females) who had been classified as "learning disabled". Subjects in both samples ranged in age form 12 to 14. Because of the extreme socioeconomic hemogeneity of the sample school district, demographic differences (social class, race, parents' educational backgrounds) between the two groups were minimal.

Each subject was administered the CALIP, from which an overall level of computer aptitude and relevant demographic data were obtained. Scores earned on four of the CALIP's subtests (Estimation, Graphic Patterns, Logical Structures, and Series) are converted to standard scores which combine to yield a Computer Aptitude Quotient (CAQ). In order to adapt the CAQ to contingency table analyses, a median cut-point was used to dichotomize the measure.

The CALIP's reliability was determined by internal consistency and stability over time. The Spearman-Brown split-half procedure and the coefficient alpha, developed by Cronbach (1951; Popham, 1981) were used to establish the test's internal consistency reliability. In all subtests, the criterion of .80 was met or exceeded. Stability was established through test-retest procedures, revealing a small error determined by the standard error of measurement.

Validity for the CAQ was determined by the degree of conformity of subjects to criteria established by Gronlund (1971:90). In each of seven separate validity studies, statistically significant results were obtained. Interested readers are urged to consult Chapter 2 of the CALIP manual which reports reliability and validity data (Poplin, et al, 1984).

Results

The results of the study are presented as they are related to the three null hypotheses that were tested.

Ho_1: There is no relationship between computer aptitude and learning disabled and non-learning -disabled subjects.

Table 1 shows that within learning disabled and non-learning-disabled groups, there was no significant difference in computer aptitude, as measured by the CALIP ($X^2 = 2.32$; df = 1). Only minor variations were found to exist in computer aptitude across both groups. Therefore, the failure to reject the null hypothesis indicated that, with respect to computer aptitude, no significant differences appeared to exist between subjects classified as learning disabled and those subjects classified as non-learning-disabled. Although Chi-Square estimates indicate the reliability of between-group differences, they do not indicate the degree of association between the variables contrasted (Cohen and Cohen, 1975). Thus, phi coefficients, an association measure in the 2 X 2 case, were also calculated. The reported $\emptyset^2$ of .021 between learning disabled and non-learning disabled subjects and their respective CAQ scores indicated that the relationship between computer aptitude and subject learning classification was marginal, at best.

Table 1. Learning disabled (LD) and Non-learning disabled (NLD) by Computer Aptitude Quotient (CAQ).

CAQ	NLD	LD	Total
High	27(25)	23(25)	50
Low	29(31)	33(31)	62
	56	56	112

$X^2 = 2.32^*$; df = 1; $0^2 = .021$

* X^2 (N. S.)

Note: Expected Values in parentheses.

The second area of interest in this study was the intra-group sex differences in CAQ scores for non-learning disabled subjects. The null hypothesis tested was:

> Ho_2: There is no relationship between sex and computer aptitude for non-learning disabled subjects.

Table 2 illustrates the finding that no significant difference existed in computer aptitude scores between male and female non-learning disabled subjects ($X^2 = .06$; df - 1). Thus, the null hypothesis was not rejected. The low 0^2 of .001 indicated almost no relationship between the dependent variable (CAQ) and the independent measure, sex. This supports the notion that computer aptitude is not a sex-dependent trait. Furthermore, non-learning disabled males and females, according to the CALIP index, possess the same potential for achievement in computer-related activities.

Table 2. Non-learning disabled (NLD) by Sex and CAQ.

CAQ	M	F	Total
High	12(13.5)	15(13.5)	27
Low	16(14.5)	13(15.5)	29
	28	28	56

$X^2 = .06^*$; df = 1; $0^2 = .001$

* X^2 (N. S.)

Note: Expected Values in parenthesis.

The final area of interest, the intra-group sex differences in CAQ scores for those subjects classified as learning disabled, was tested by the following hypothesis:

> Ho_3: There is no relationship between sex and computer aptitude for learning disabled subjects.

Table 3 shows that a significant difference in computer aptitude between male and female subjects, classified as learning disabled, was found ($X^2 = 5.84$; df = 1; $p < .05$). Furthermore, the reported 0^2 of .10 revealed a slight relationship between sex and CAQ score. In this case, the rejection of the null hypothesis implies that some aspect of learning disabilities creates a disparity in computer between male and female junior high school students. By contrast, non-learning disabled students versus learning disabled appear to be statistically homogeneous in computer aptitude, irrespective of sex.

Table 3. Learning disabled (LD) by Sex and CAQ.

CAQ	M	F	Total
High	16(11.5)	7(11.5)	23
Low	12(17.5)	21(17.5)	33
	28	28	56

$X^2 = 5.84^*$; df = 1; $0^2 = .10$

* $p < .05$.

Note: Expected Values in parenthesis.

Discussion

The results of this study support former research (Hearne & Lasley, 1985; Poplin et al., 1984) indicating that computer aptitude is not gender-specific. Where marginal differences existed between male and female learning disabled students, a general emphasis upon reading and language in resource programs had possibly contributed to a delay in mathematical (conceptual) development among females. Likewise, the general level of interest in computers among males was higher than that expressed by females, as was experience.

Because there was no significant difference between CAQ scores for the two groups in this sample, there is no evidence to support propositions about differences in reasoning ability or mental processes among the learning disabled. The same or similar skills required for success at computer-related activities were present in both groups.

The study does, however, support notions about the merits of computer intervention with the learning disabled. There is reason to believe that such activities engage reasoning at the same levels for both learning disabled and non-learning disabled students, suggesting that the groups begin to approximate each other in thought.

References

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 219-224.

Cohen, P. & Cohen, J. (1975). Applied multiple regression/correlation analysis for the behavioral sciences. Hillsdale, NJ: Wiley & Sons.

Gardner, H. (1982). Art, mind, and brain: A cognitive approach to creativity. New York: Basic Books, Inc.

Gardner, H. 1983). Frames of mind: The theory of multiple intelligences. New York: Basic Books, Inc.

Gardner, H. (1985). The mind's new science: A history of the cognitive revolution. New York: Basic Books, Inc.

Gronlund, N. E. (1971). Measurement and evaluation to teaching. New York: Macmillan.

Hearne, J. D. & Lasley, J. (1985). The relationship between achievement factors and gender-specific computer aptitude among junior high school students. Education, 106, 81-87.

Kerchner, L. B. & Kistinger, B. J. (1984). Language processing/word processing: Written expression, computer and learning disabled students. Learning Disability Quarterly, 7, 329-335.

Kolich, E. M. (1985). Microcomputer technology with the learning disabled: A review of the literature. Journal of Learning Disabilities, 18, 428-431.

Konvalina, J., Wileman, S. A. & Stephens, L. J. (1983). Identifying factors influencing computer science aptitude and achievement. Association for Educational Data Systems Journal, 16, 106-112.

Meichenbaum, D. (1980). Teaching thinking: A cognitive-behavioral approach. (Monograph). *Society for Learning Disabilities and Remedial Education*, 2.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books, Inc.

Popham, W. J. (1981). *Evaluating instruction*. Englewood Cliffs, NJ: Prentice Hall.

Poplin, M. (1983). Redefining learning disabilities: An holistic perspective. *Claremont Reading Conference*, *41*. 143-155.

Poplin, M. (1984). Summary rationalizations, apologies and farewell: What we don't know about the learning disabled. *Learning Disability Quarterly*, *7* (2), 130-135.

Poplin, M. (1984). Toward an holistic view of persons with learning disabilities. *Learning Disability Quarterly*, *7* (4), 290-294.

Poplin, M. S., Drew, D. E., & Gable, R. S. (1984). *Computer aptitude, literacy, and interest profile*. Austin, TX: PRO-ED.

Reid, D. K. & Hresko, W. P. (1981). *A cognitive approach to learning disabilities*. New York: McGraw-Hill, Inc.

Torgensen, J. K. & Young, K. (1983). Priorities for the use of microcomputers with learning disabled children. *Journal of Learning Disabilities*. *16*, 234-237.

Turkle, S. (1985). *The second self: Computers and the human spirit*. New York: Simon & Schuster.

Zemke, S. Microcomputers and education: Choices and consequences. *Educational Computer*, *3* (2), 42-45.

Social Skills Development And Microcomputer Use For Handicapped Adolescents

Marie Hegwer
California High School
Whittier, California

Kathleen Harris and M. Diane Klein
California State University, Los Angeles
Los Angeles, California

Abstract

Using microcomputers to develop social skills has not been widely addressed by special educators. The impetus for the suggestions presented in this paper was an eight week observational study of the behavior, on and off the computer, of a class of seriously emotionally disturbed (SED) adolescents. An in-depth case study of one student in the class revealed that the student was able to maintain the most on-task behavior when paired with another student on a computer activity. Further analysis of the social behavior of the target student suggested three issues to consider when using the microcomputer to develop social interaction skills.

First, by virtue of its characteristics, the computer can provide a unique situation around which social/communication behavior can occur. Second, software could be used in many different ways to facilitate social interaction. Third, the roles an individual plays in an interaction involving a computer can be influential in the development of social skills.

Based on these identified issues, an initial conceptualization of a social skills curriculum, utilizing the microcomputer, is presented. This curriculum addresses the following areas: physical/environmental factors, self-concept, and interaction. It is recognized that each area requires modification for different goals and different classrooms.

Microcomputers have been incorporated into many special education activities, both within and outside the classroom. Within the classroom, special education teachers have been using microcomputers in the following ways: to teach computer literacy to handicapped students, to reinforce basic skills, to teach writing, and to develop logical thought processes. Though the behavior of handicapped students, when engaged in these activities, if often reported (e.g. students behave appropriately or display a positive attitude when using the microcomputer), few special educators have directly addressed the use of a microcomputer to develop the social skills of handicapped adolescents.

The following suggestions for developing social skills using microcomputers were originally developed from an eight week study of a high school program for seriously emotionally disturbed (SED) students. At that time, the class consisted of eight students, ranging in age from 15 to 22 years; one teacher; two aides, and one to two observers. There was one Apple IIe computer in the classroom which was used to strengthen student's basic skills as well as reinforce appropriate behavior (e.g. students could play computer games when tasks were completed).

The special education teacher was interested in obtaining information which would describe the social behavior of students in this class when on and off the computer. Videotapes were made to students in the SED class when engaged in the following situations: working independently on and off the computer, working with a nonhandicapped peer on and off the computer, working with a handicapped peer, working with the teacher, and playing a game on and off the computer. A case study approach was used in analyzing the videotapes of one student. The focal student, Theresa, was 20 years old, read at a first grade level with good oral language comprehension, and was able to follow directions. However, Theresa was hard to motivate, did not visually complete tasks, was a "busybody" and tended to lack courtesy.

In addition to videotape information, additional information, obtained through field observation of the program and teacher's comments regarding program goals and individual student performance, was used in the analysis. The results and conclusions of this analysis were the foundation for the development of a social skills curriculum utilizing microcomputers.

Initial inspection of Theresa's on-task behavior yielded the results found in Table 1.

Table 1
Theresa's On-/And Off-Task Behavior

	On-Task (Duration)	Off-Task (Duration)	Off-Task (Frequency)
Computer	94.9%	5.1%	$\bar{x}$ = 14.4
vs.			
Noncomputer	81.75%	18.25%	$\bar{x}$ = 11.86
Independent	76%	24%	$\bar{x}$ = 21
vs.			
Paired	98%	2%	$\bar{x}$ = 4.83
Computer Paired	98%	2%	$\bar{x}$ = 4.67
vs.			
Noncomputer Paired	98%	2%	$\bar{x}$ = 5
Noncomputer Team	98%	2%	$\bar{x}$ = 5
vs.			
Noncompter Parallel	69%	31%	$\bar{x}$ = 18.33

The results reported in Table 1 suggested that more time spent on-task than off-task when Theresa was working with the computer. However, Theresa maintained at least 80% behavior whether on or off the computer. When the on-task behavior of paired activities was compared to the on-task behavior of independent activities, Thereas's on-task behavior when paired with another individual greatly exceeded her on-task behavior when working independently. This increased on-task behavior was more evident when Theresa was working on the same task as the other individual (i.e. teamed) than when she was working on an individual assignment but placed in close proximity to another individual (i.e. parallel).

These initial findings suggested a further qualitative analysis of Theresa's behavior. This qualitative analysis led to the following general questions and comments:

Is she less likely to attend to other people, noises, etc. when on computer?

To what extent do the positive aspects of computer (reinforcement, motivation, success, external structure, non-human) create an atmosphere facilitating social interaction?

Is the computer perceived as fun; does that facilitate its use?

Is the monitor a _focus_ of activity; is that a facilitating characteristic?

In a setting when the instructional goal is social interaction, what _is_ off-task behavior?

Is there a point at which on-task behavior is inappropriate?

Is it normal to look ahead at how much unpleasant work remains?!

Is it a measure of SEDness how these students do totally unacceptable behavior right smack in front of a camera?????

It is a problem in SED class of not having appropriate, responsive language/pragmatics models?

Note absence of arguments in unsupervised activity.

What effect is substitute teacher on behavior?

What factors characterize "interaction" beyond that of speech itself?

Is "shut up" used as an all-purpose communication?

Data may show here better when paired but I suspect it is specific to the person with whom she is paired (none of these people were strangers).

Remember comments here may not/and probably do not generalize.

To what extent can peculiar behavior be matched to job requirements?

i.e. BH always smiling & happy; fast food boss loves it

T seldom overtly happy; fast food boss concerned

MK rigidly neutral; janitor boss says he's industrious & concentrating

From the analysis, three issues were identified. First, the computer itself presents a unique situation in a classroom environment. It is tangible, provides a visual focus, is easy to manipulate, is interactive, and enables the student to produce an effect, whether or not the student knows the correct response. These characteristics promote the student's ability to initiate and respond and enhance the motivational value of the situation. As such, the potential of the situation for social interaction is even more unique.

Software can be used in many different ways to facilitate social interactions. In many instances, software is best used educationally in ways other than those of its original design. In educational uses of software for the development of social interactions, such variance is even more common. For example, a program intended for peer competition can be used by two students teamed against the computer. Or, an individual tutorial program may be better used as a foundation for teacher-student interaction. Or, groups of students can use a program designed for use by individuals. Many such examples could be given. The point is that the intent of a software designer or instruction manual may not facilitate social interaction for every individual in every classroom but, the software can often be used to facilitate social interaction.

Finally, the nature of the roles in an interaction appears to be very significant. The special education adolescent working on one program may be a cohort, a competitor, a tutee, or a tutor. Experience in each role is useful and can be provided across many types of software and in many types of situations. Selection and/or training of non-handicapped peers to fill a variety of roles is important. The perceived status level of such peers must be taken in account. Also, non-handicapped peers are more likely to model desired language and social skills. Attention must be given to those and other such issues in structuring a situation which facilitates the development of social interaction skills.

The following represents an initial conceptualization of the key components of a social skills curriculum using microcomputers. The areas of physical/environmental factors, self-concept and interaction are addressed. Each are requires modification for different goals and different classrooms. These factors function in their own complex interaction and must be taken into consideration in determining current status and future planning.

The following position is taken: social development, especially in an SED class, is extremely important and also pervades all other areas of development. Ultimately, all instructional goals are intended to maximize the individual's socialization. Social interaction occur in all domains and across all curricular content areas.

1. Physical/environmental

In developing social skills, it appears that there are few absolutes across groups or an individual. There may be several factors which affect the utilization of social skills in a given situation. To some extent, perhaps these factors can be manipulated instructionally, enabling students to progress through and/or practice skills in these different settings. It may also be possible for students to become aware of the variations in factors which facilitate or impede the utilization of their skills. Perhaps a given student could then modify the setting or utilize compensatory skills.

1.1 Overall Issues

1. Safety
2. Motivation -- to participate or avoid
3. Familiarity -- strangeness or known

    4. Comfort -- physical & emotional
    5. Physical proximity -- to people or things
    6. Distraction -- stimuli values; activities, people, home

1.2 On Computer

    1. Focal point -- utilize stimuli value, novelty
    2. Activity -- teamed or competitive
    3. Content -- academic, leisure...
    4. Partner selection
        -- self
        -- teacher: known, unknown; like, dislike; ability...

1.3 Off Computer

    1. Activity
    2. Content
    3. Partner

2. Self

Each individual has certain existing characteristics which must be considered in future developing social skills. These characteristics must be assessed. The individuals should gain awareness of their skills and needs.

It is assumed that an individual's self-concept and self-awareness will affect interactions. Again, these skills probably operate in a complex relationship. Roughly, an improvement in self-concept should improve social interactions and enhanced interaction skills should improve self-concept.

Perhaps instruction can then be used in an attempt to modify some personal characteristics, to identify tasks or settings which can be accommodated to the person, to develop compensatory skills, and/or some combination maximizing social development and utilization or social skills.

Through the curricular/instructional process, staff are continually seeking to maximize social skill development in a specific setting and to create generalization to all settings, activities, language, prompts, and cohorts/audience.

2.1 Knowledge/awareness -- level and realism

  1. Self
    a. Skills
    b. Needs
    c. Compensation
  2. Environment
    a. Surroundings
    b. Interactions
    c. Activity

2.2 Behavior

  1. Control
  2. Responsiveness/receptivity
  3. Communication

2.3 Growth and development

  1. Motivation
  2. Comfort
  3. Generalization

3. Interaction

Instructionally, the assumption is that social development may be improved or facilitated through "interactions" with oneself, a computer, the teacher, and other students. There are many factors to consider in each of these areas.

3.1 Factors

Each factor represents a continuum or range of possible intensities/situations. Perhaps at first it would be useful to determine the optimal comfort levels for the student and use that information to structure initial situations. Then, factors may be slowly altered and/or recombined to facilitate generalization and ease in additional situations to eventually broaden the student's comfort range.

1. Supervision: directed ... undirected
2. Process: structured ... unstructured
3. Who: machine ... staff ... peer ... stranger
4. Domain: home ... school ... community ... vocational
5. Role: observer ... cohort ... competitor

3.2 Situations

There may be different reactions from different students in different situations. Perhaps the student again may be guided from comfortable situations slowly to gain comfort in other situations through use of the computer. Of course, in each situation there are many factors to consider and each factor would have various dimensions and intensities. This outline is intended only as a framework for further development. It is assumed that off-computer situations are beyond the scope of this paper.

3.2.1 Interactions with self

- awareness
- communications
- motivation
- self control
- planning
- self improvement
- interest
- leisure

3.2.2 Interactions with computer

- 3.2.2.1 Input/output modalities
- 3.2.2.2 Software
    - 3.2.2.2.1 Characteristics
        - patience
        - feedback
        - speed
        - reinforcement
        - appeal
        - language
    - 3.2.2.2.2 Goal
        - give & take
        - opinions
        - novelty
        - waiting
        - feedback
        - pressure
    - 3.2.2.2.3 Process
        - selection
        - compare scores
        - ordering
    - 3.2.2.2.4 Type
        - drill
        - simulation
        - utility
        - game
        - tutorial

3.2.3 Interactions with teacher in computer situation

- 3.3.3.1 Indirect interaction by teacher
    - selection of software

scheduling of use
record keeping
set-up

3.2.3.2 Direct interaction by teacher
passive
slowly increase physical proximity
comment/question - no s response
reinforce, parallel to computer
active
work/play with
question/answer
team member, cohort
planning

3.2.4 Interactions with peer in computer situations

3.2.4.1 Format
one-on-one: Parallel ... teamed
small group

3.2.4.2 Role
peer: cohort ... competitor
tutor: access ... read ... assist

3.2.4.3 Who
age
gender
NH?

3.2.4.4 Content
academic ... leisure
software selection

3.2.4.5 Location

familiar ... unfamiliar

3.2.4.6 Structure

provided ... open

3.2.5 Interactions with teacher off computer

3.2.6 Interactions with peers off computer

Three appendicies have been included to provide additional resources for educators who wish to develop the social skills of handicapped adolescents. Appendix A provides examples of software useful for developing social skills. Appendix B lists related materials and publishers. Appendix C provides a listing of books useful in the development of social skills.

Appendix A

Software

The following software are intended as examples; certainly other appropriate software exists. While perhaps not commonly considered as such, these programs can be very useful in the adolescent special education class for the development of social interaction skills. The teacher should manipulate roles, stated goals, and other factors as needed to appropriately structure the situation.

Scholastic	Microzine (assorted volumes)
Sierra On-Line	Dragon's Keep
	Troll's Tale
MECC	Word Munchers
	Oregon Trail
	Elementary Volume 7

Broderbund	Where in the World is Carmen
	San Diege
	Print Shop
Tom Synder	The Other Side
Ginn	Suspect Sentences
DC Heath	A Survey Kit
Hartley	Memory Match
CBS	Murder by the Dozen
Springboard	Certificate Maker
Grolier	Treasure Hunter
	Science Island
Advance Ideas	Game Show
	Tic Tac Show
Davidson	Grammar Gremlins
Action Craft	Pick-A-Dilly Pairs

Appendix B

Related Materials -- Publishers

These non-electric materials may be useful in augmenting a social interaction curriculum. Many are available at local educational supply houses. Generally, these materials help a teacher to structure enjoyable *and* pragmatic interactional situations.

Educational Apple-cations	Mary Male book
194 Wedgewood Ave.	($17.95)
Los Gatos, CA 95030	
Educational Insights	Values
Compton, CA	Write In! Vol. I, II, III

Good Apple Box 299 Carthage, IL 62321	Feelings
Hoyle Products (@ local game store)	Pocket Principles
Lingui Systems 716 17th Street Moline, IL 61265	Encounters: Solving Communication Problem in Adult Situations Communication Workshop Situational Language Manual of Exercises for Expressive Reasoning
Merrill Pub. Columbus, OH 43216	Let's Talk--Developing Prosocial Communicating Skills (by E. H. Wigg)
Thinking Publications 10 Platt St. P.O. Box 163 Eau Claire, WI 54702-0163	Referential Communication Breakaway Problem Solver Communicate Scripting: Social Communication for Adolescents
Think Ink Pub. 3421 N. 44th St. Phoenix, AZ 85018	Simulations

Appendix C

Related Books

Beach, D.M., Reaching Teenagers: Learning centers for the secondary classroom.

Bee, C.P., Secondary Learning Centers: An innovative approach to individualized instruction.

Bender, M., & Valletutti, P.J., Teaching Functional Academics: A curriculum guide for adolescents and adults with learning problems.

DeMille, R., Put Your Mother On The Ceiling: Children's imagination games.

Goldstein, A.P., Sprafkin, R.P., Gershaw, N.J., & Klein, P., Skill streaming The Adolescents: A structured learning approach to teaching prosocial skills.

Hendricks, G., & Roberts, T.B., The Second Centering Book: More awareness activities for children, parents, and teachers.

Hendricks, G., & Wills, R., The Centering Book.

Hoffman, J., Critical Incidents.

Howe, L.W., & How, M.M., Personalizing Education: Values Clarific-tion and beyond.

Kaplan, P.G., Crawford, S.K., & Nelson, S.L., Nice: Nifity innovations for creative expression.

Maid, A., & Wallace, R., Not Just Schoolwork: New directions in written expression.

Male, M., Johnson, R., Johnson, D., & Anderson, M., Cooperative Learning And Computer: An activity gudide for teachers.

Schrank, J., Teaching Human Beings: 101 subversive activities for the classroom.

Simon, S., Hawley, R.C., & Britton, D.B., Composition For Personal Growth: Values clarification through writing.

Simon, S.B., Howe, L.W., & Kirschenbaum, H., Values Clarification: A handbook of practical strategies for teachers and students.

Stevens, J.O., Awareness: Exploration, experimenting, experiencing.

Taylor, J., & Walford, R., Learning And The Simulation Game.

Wagner, G., Gilloley, L., Social Studies Games and Activities: Strengthening social studies skills with instructional aids.

Standard Software For Our Not-So-Standard Hardware

Tim Hendtlass
Swinburne Institute of Technology
Hawthorne, Victoria, Australia

Abstract

A system of standard software modules could lower the time and cost of producing support software for people with disabilities. The increase in productivity per hour that could be obtained would be enormous if a system could be developed that was machine independent and whose modules were able to be interconnected in the field into a wide variety of configurations without any computer knowledge. This paper presents one way in which such a system of modules may be produced and used.

Preamble

The mass production of commercial microcomputers has had a major impact on the possibilities open to persons with disabilities. However, the decreasing cost of hardware has been accompanied by an ever increasing cost (in time if not dollars) of the required software. This is caused by the ever increasing complexity demanded of the software as we discover how many previously unaccessible skills a user to unlock from inside themselves when assisted by a computer.

Until recently one type of computer has dominated the rehabilitation field and as a result there has been an approximate de facto standard which has made it possible to share software. This is unlikely to continue much longer as the range of machines in wide spread use is increasing, partly because of market economic forces and partly because the original workhorse is unable to meet some of the heavier computational demands now being made.

As a result of these trends people all over the world are having to invest a great deal of time producing programmes, often duplicating each others work, either through ignorance or because they are using different machines. The lead time between program conception and birth in a usable form is growing longer, which tends to preclude any fast response to therapeutic inspiration or client evolution.

The time is therefore ripe for an attempt to define an optional but desirable software standard to allow us to produce programmes faster and to continue to share software even if we are using different hardware. This could be achieved if we had available a set of standard modules or program pieces which:-

> could be clipped together readily in the field without any detailed knowledge of how each piece worked,
>
> could be joined in any way which made sense in the context of designing a software aid,
>
> would work on any make or model of computer that could provide suitable inputs and outputs to suit the particular application,
>
> and be usable in any language (English, French, etc.).

There would need to be a (very) few hardware dependent modules that have to be written once for each piece of hardware. They should be easily distributed among users of that particular hardware. There would be a much larger number of hardware independent modules that once written anywhere in the world could be simply distributed and then run unaltered on any computer for which the hardware dependent modules exist.

The ability to modify the software in the field on whim is an important feature designed to give flexibility to the care giver. It is envisaged that the ability to try a number of different approaches in an ad hoc way would prove desirable during the evaluation of a client. This may be likened to an optician who uses a set of lenses to approach the correct lens formulation for a new client by a process of successive approximation. In order to achieve a suitable level of flexibility to meet the diverse needs of therapy the software must be highly modular and designed in such a way that modifying any given module is fairly trivial and generating new modules is quite practical.

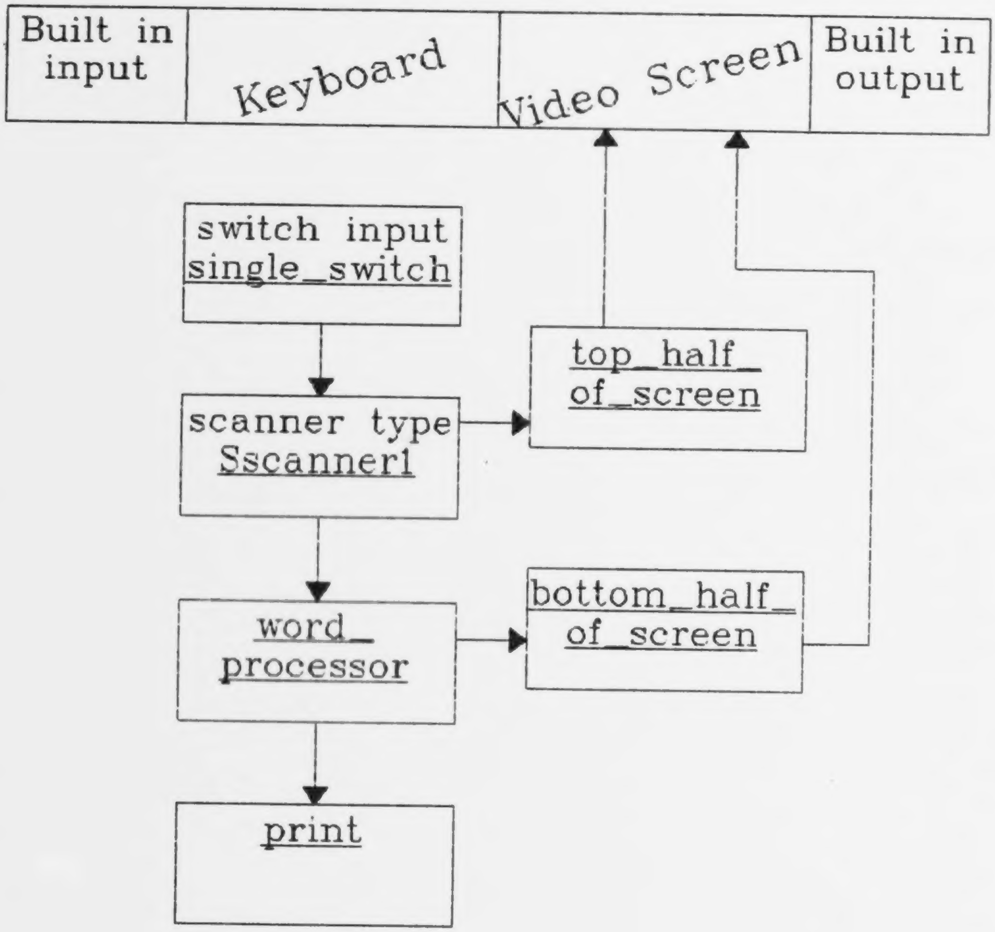
The rest of this paper considers one method by which these goals may be met. The method described is fully practical and has been implemented mainly on an IBM PC. It is in no way limited to that machine and work is under way to implement it on an Apple II. Although it has not been attempted at the time of writing, it appears that very little effort would be needed to have the system running on a wide range of other computers, including the Macintosh, Amiga, TRSBO, Atari 520T, Commadore 64 to name only some. Transferring to portable machines such as the Epson, NEC and Toshiba should not pose great difficulty as long as one condition discussed below can be met.

How To Use This Software.

Probably the best way to introduce the software is to give an illustration. Consider an aid in which a single switch is used to drive a scanner so that the user can select individual letters. These letters are then passed to a small single line word processor and the sentence is sent to a printer when completed. There is a video screen to provide feedback to the user, the scanner being displayed on the top half of the screen and the sentence that is being built by the single line word processor on the bottom.

A way has been developed to diagrammatically represent the aid so that the lay out is chosen to make the task of turning the picture into a program as simple as possible. The user input is shown on the top left and the output from the computer to guide the user on the top right. Facilities for user input and user guidance that are built into the computer as standard are always shown in a band at the top although they need not be used. In the example in the figure the ordinary keyboard and the video display are standard and so shown in the built-in facilities band. They can be used without having to do anything special first. Anything else that is needed must be asked for before it can be used. A large selection of facilities and features will form part of the standard and be available from disk when needed. In the diagram the modules are placed so that the output from each (scanner, word processor or printer interface in this example) passes to the module beneath it - except for the last module which is at the bottom of the page and therefore has no further module to pass information onto. The user guidance produced from any module comes out of that module and then back up the left hand side, possible passing through display control modules on the way to the user guidance output (normally the video). The arrows which show which module feeds what information to which other module could be color coded to further simplify things but this is not able to be shown on a conventional printed page.

To turn the diagram into a program that can be used requires only that a few lines of English like text be input, either from the keyboard or from disk. There are only two basic types of lines that the computer has to be concerned with, things to do and things to remember. So that the computer can tell these apart, things to remember are preceded by a colon space and terminated by a space


Built in input
Keyboard
Video Screen
Built in output
switch input
single_switch
scanner type
Sscanner1
top_half_
of_screen
word_
processor
bottom_half_
of_screen
print

semicolon (the lines of text between a bracket space and a space bracket - like this sentence - are comments to remind the programmer what they were doing and are totally ignored by the computer).

The program, after a single line that says giving the program name, consists of stating what modules are to be used, where their input comes from and where their output goes to (the blocks and the arrows from the diagram). Actually if you have told the computer that module B gets its input from module A it is somewhat redundant to tell module A to send its output to module B as it already knows. A simple rule prevents important information being omitted while at the same time avoiding redundancy - if the arrow is going down the page you state where a module gets its input from, if it goes up the page you tell it where it is to send its output to. In either case you have to give this information before you put the module in place. All of which sounds much more complicated than it is as can be seen by looking at the complete program below that corresponds to the figure.

```
                 - - - - - - - - - - - - - - - - -
                                   (First Line - Name The Program)
     create demo program
                 - - - - - - - - - - - - - - - - -
                    (Second Line - Ask For What The User Will Use)
     get single switch
                 - - - - - - - - - - - - - - - - -
       (Third Line - Where Top Half Of Screen Will Send Its Output)
     : Output to video ;
                 - - - - - - - - - - - - - - - - -
                (Fourth Line - Ask For The Display Module You Want)
     get top half of screen
                 - - - - - - - - - - - - - - - - -
                (Fifth Line - Where Sscanner1 Is To Get Input From)
     : Input from single switch;
                 - - - - - - - - - - - - - - - - -
                 (Sixth Line-Where Sscanner1 Is To Send Its User
                                                  Guidance Output)
```

: Output to top half of screen;

- - - - - - - - - - - - - - - - - -

(Seventh Line-Now Ask For The Module)

get Sscanner1

- - - - - - - - - - - - - - - - - -

(Eighth Line-Where Bottom Half Of Screen Is To Send Its Output)

:output to video;

- - - - - - - - - - - - - - - - - -

(Ninth Line-Ask For The Second Display Module)

get bottom half of screen

- - - - - - - - - - - - - - - - - -

(Tenth Line-Where Word Processor Is To Get Its Input From)

:input from Sscanner1;

- - - - - - - - - - - - - - - - - -

(Eleventh Line-Where It Is To Send Its User Guidance)

:output to bottom half of screen;

- - - - - - - - - - - - - - - - - -

(Twelfth Line-Ask For The Word Processor Module)

get word processor

- - - - - - - - - - - - - - - - - -

(Thirteenth Line-Where Print Is To Get Its Input From)

:input from word processor;

- - - - - - - - - - - - - - - - - -

(Fourteenth And Last Line-The Module That Is The Basic Reason For The Program)

get print

- - - - - - - - - - - - - - - - - -

These fourteen lines are all that there is to the program. After they have been typed in the whole thing is started by typing the name of the last module (in this case print). It will run until control C (^C) is typed on the keyboard. Entering

forget program_name

when the program is finished with (in this case forget demo program) will cause the program to vanish. To save typing a program that is going to be used often, it can be stored on a disk and recalled from there rather than having to enter it again through the keyboard.

As you might guess from the use of different typefaces the words that make up the program fall into several groups. Words shown in heavy large type - such as 'get' - are special words that have meaning to the software standard program. Words shown in italic - such as 'print' - are the names of pre-written modules. Modules, like the programs you write, are given names and referred to by those names. A name can be anything except one of the special words and can have up to 32 printable characters in it. The only character it must not contain is blank - hence the use of the underscore (_) to make things more readable. Naturally when you actually enter a programme you do not need to use special character sizes or fonts. In fact you can use all upper case or all lower case letters or any mixture you like - the program will not know the difference.

The modules are entered from the top of the page to the bottom and from left to right were there are two or more modules on a line. The only rule to observe is that you must not 'get' a module until you have specified where its input is to come from (and where its output is to go to if necessary) and in these input and output statements you may not mention any other module that has not been 'got' yet.

What To Do When The Module You Need Doesn't Exist.

As the available pool of modules increases - remember that most modules will run on any machine which supports the standard - this should happen less and less frequently, but there will always be the special need. For this reason as well as standard modules there will also be customizable versions of the same module. For example take the standard scanner, Sscannerl, that was used in the program above. When this was specified the number of rows and columns, the arrangement of the letters and what was to be output for each selection made were also specified. The custom version, Cscannerl, lets the user specify the number of columns and rows, what is to be shown in each place (which letter or drawing or whatever) and what is to be sent out when a selection is made. The price paid is a little more programming. For example to get a three by two display showing the number 1 to 6 and outputting their ASCII equivalents requires the computer to be given more to remember. The line get Sscanner1 is replaced by the lines:-

```
:  rows 2 ;
:  columns 3 ;
:  display 6, #1, #2, #3, #4, #5, #6,
```

(Note Funny Use Of Commas - There Must Be Blanks On Either Side Of The Commas And Yes The Last Comma Is Needed! The 6 Is The Number Of Things To Display And #1 Etc. Are Standard Graphics Characters. You Could Display A Picture Of A Cat Or Dog Or ... As Long As Somewhere Before This You Told The Computer How To Draw A Cat Or Dog Or ...)

```
:  send 49, 50, 51, 52, 53, 54,
     (Same Again - The Numbers Are The Decimal Values Of The
     Characters 1 2 Etc In The ASCII Sequence)
get Cscanner1
```

The documentation for each customizable module must give clear instructions as to what information you have to give the computer to use it along with at least one example.

Adding To The Pool of Modules.

Using a customizable module is something which is expected to become standard practice for therapists in the field and should become a non-event after just a little practice. Writing a module from scratch, on the other hand, is a little more complicated. The implementation language used in this work so far, and which is not expected to change, is FORTH. FORTH is a powerful stack oriented language with some special features which lend themselves to this sort of application. While not hard to learn, the task of writing a new module on the fly in the field is not one which is recommended. Modules will probably be written in many places and to ensure compatibility of one written in Australia for an IBM with one written in the USA for an Atari (or any other pair of places and computers you care to name) some simple rules have been developed. These are:-

All modules shall use the FORTH 83 standard.

Modules will expect input from another module on the stack, with the first item of input at the lowest position on the stack and with a count of items on the top of the stack. No information may be passed in variables. Naturally a module passes output to another module in the same way.

All video display shall be designed to fit on a pseudo screen of 640 by 400 points, it will be adjusted to the actual screen definition automatically to suit whatever machine it is being run on.

Modules will get input be executing input (or input1, input2 etc. if there is more than one input to the module) and pass user display information by executing output.

The standard words in the next section may be assumed to exist on every implementation.

Moving This Software to Another Type of Computer.

The first requirement is a version of FORTH for the particular computer. As these exist for a wide range of machines this is unlikely to pose much of a problem, except perhaps for some of the newer portables. The standard words KEY and ?KEY which get a character from the keyboard and see if there is a character waiting at the keyboard must be implemented.

The major routine which has to be written is !DOT which plots a dot on the screen. It expects the horizontal coordinate, the vertical coordinate and the colour on the stack with the colour at the top. The origin for the coordinate system is top left corner, with x increasing left and y down. The values on the stack on entry refer to the 640 by 400 pseudo screen and have to be truncated to the resolution available on the target system. Colour is to be interpreted as zero to mean background and non-zero to mean foreground on a monochrome system. On a colour system zero still means background but non-zero values determine the colour to be plotted (truncated to the number of bits that make sense for the number of colours available). All video output is to be via !DOT.

The rest of the standard is written in FORTH and should require no modification, it just has to be read off disk (or typed in - a slightly boring task).

Distributing The Results Of Our Labours.

Any special machine specific hardware, a serial port card for example, will need to have its own software written in FORTH to suit the system. The routines will usually be fairly trivial and easily distributed among users. Any new module (there will be example probably be quite a number of scanners etc.) should be written up in a standard format so that it can be widely distributed. A new implementation should be fully documented for others to follow, distribution via disk or tape would be preferable if it can be done without violating copyright but even then written documentation should be available too.

Suggestions as to how the distribution can be best and most cheaply carried out are eagerly sought, as are any other contributions to the development of a suitable standard. Please contact the author at the address given at the start of this paper.

Conclusion.

The approach to standard machine independent software described above is being actively pursued. It has reached the stage at which it is definitely technically possible. Input of all types from interested potential users will help ensure that it is practical as well. No one would ever be forced to use this (or any other) standard, if it is to be successful it must be useful and user-friendly enough that people want to use it. Time will tell if the approach outlined above will past this acid test.

Appendix.

This appendix gives some information on the details of implementation for the benefit of the curious reader who is familiar with Forth. It must be stressed that an understanding of this appendix is not necessary to use the proposed standard. It is given in two parts, the minimum machine dependent code needed - in this case for an IBM PC - and a minimum machine independent implementation. This latter part is a development version only and may need to be expanded depending how the evolution of the proposed standard goes.

The machine dependent part of the proposed standard for an IBM PC equipped with a color/graphics video interface.

```
HEX (set number system to hexadecimal)
(MODE - expects a number on the top of the stack which is used to set
the video mode)
CODE MODE AX POP, VIDEO CALL, NEXT, END-CODE
(Define a standard text and a standard graphics mode)
3 CONSTANT TEXT
6 CONSTANT GRAPHICS
(define a variable for line plot attributes and initialize it to 7)
VARIABLE ATTR  7 ATTR!
(define a word PALETTE which selects the colour palette to use based
on the top of the stack)
CODE PALLETE 09 # AH MOV, BX POP, VIDEO CALL, NEXT, END-CODE
(define !DOT which plots a dot on the screen with x, y and color on
the stack on entry)
```

```
CODE !DOT AX POP, OC # AH MOV, DX POP, CX POP, VIDEO CALL, NEXT, END-
CODE
(define @DOT which reads a dot from the screen, enter with x, y on
stack, exit with dot value on stack)
CODE @DOT OD # AH OV, DX POP, CX POP, VIDEO CALL,
O # AH MOV, APUSH, END-CODE
DECIMAL (return number base to decimal)
```

The following Forth code is machine independent and draws a line from point x1,y1 to point x2,y2.

```
2VARIABLE INCR
(XBIGGER is used to plot when x2-x1> y2-y1.  It expects x1 y1 x2 y2
on the stack on entry (y2 on top))
: XBIGGER 3 PICK 2 PICK> IF 2SWAP THEN 4DUP ROT - ROT ROT SWAP - SWAP
1000 SS*D ROT M/MOD S>D
INCR 2! 2DROP SWAP 1000 SS*D 3 ROLL SWAP DO 2DUP 1000 M/MOD SWAP DROP
I SWAP
ATTR @
1DOT ICR 2@ D+ LOOP 2DROP;
(YBIGGER is used to plot when x2-x1< y2-y1.  It expects x1 y1 x2 y2
on the stack on entry (y2 on top))
: YBIGGER 2 PICK OVER > IF 2SWAP THEN 4 DUP ROT - ROT ROT SWAP - 1000
SS*D ROT M/MOD S>D INCR 2! DROP SWAP DROP ROT 1000 SS*D 3 ROLL SWAP
DO 2DUP 1000 M/MOD SWAP DROP I ATTR @ !DOT
INCR 2@ D+ LOOP 2DROP;
(The routine !LINE actually does the plotting of the vector - enter
with x1 y1 x2 y2 on the stack as above)
: !LINE 4DUP ROT - ABS ROT ROT SWAP - ABS < IF XBIGGER ELSE YBIGGER
THEN;
```

The following code is machine independent and implements the special word GET which handles the acquisition and installation of the asked for module. To understand the operation it should be noted that block one of the modules master program contains only the immediate instruction

```
FORGET ZYXMARKER
```

to forget the dictionary marker zyxmarker. Block two contains the start of an index consisting of module name followed by block number where that module is to be found. For example:-

```
: ZYXMARKER ;
: SINGLE SWITCH 3 ;
: SSCANNER1 4 ;
: WORD PROCESSOR 7 ;
: PRINTER 13 ;
```

would specify that the single switch module started at block three etc.. Modules and the index may be more than one block long by using standard random inter-block links. Zyxmarker must be the first entry in the index so that the temporary copy made during loading can be forgotten in its entirety when finished with.

The GET function is written as

```
: EXNEXT EXECUTE;
: GET 2 LOAD EXNEXT 1 LOAD LOAD;
```

The words INPUT and OUTPUT are defined and redefined as called on by the user. Remember that a module being loaded will always link to the most recent definition of a word. The words FROM, TO are null words only used to make the user input more readable. They are defined as

: FROM ; and

: TO ;.

Acknowledgements.

This work was supported by the Swinburne Institute of Technology and by the Victorian Committee of the Commonwealth Schools Commission Educational Program for Severley Handicapped Children under grants 85/280 and 86/608.

Give Me Tools And I Will Do The Job

Arthur Heyer
Extensions For Independence
San Marcos, California

Introduction

Assistive equipment makes life easier and happier for everybody. It dignifies and makes disability a natural part of a family's life: The disabled brother becomes a brother with special needs. Not a burden on the family.

The clutter of prototypes encountered in my office suggest a strong linkage to equipment. However, I do not consider myself a gadget addict. I look at my devices merely as tools to accomplish tasks.

At one time there were things I wished I could do. Now that I have the means to do them, I don't feel disabled anymore.

Assistive equipment has been a crucial part in my life since I became disabled 23 years ago at age 17. Most of this equipment has not been immediately available to me however. It has been created to solve my needs, and then perfected through the years.

In my presentation I will describe some of this equipment and show how it has been beneficial to me and those around me. I will start with a discussion of my newest mouthstick design (a refined version of th Heyer-Abadie Modular Mouthstick, which has been the cornerstone of my functional independence), then I will talk about equipment designed around the use of this mouthstick, with emphasis on equipment related to the use of computers. And I will finish my presentation with a brief discussion of three other devices that have helped to make my life easier to live.

1. Heyer-Abadie Modular Mouthstick

This mouthstick has important features which make it unique in performance capabilities. We first called it "Talking" Mouthstick because the user can easily talk while working with it. This feature is especially useful for instructors when they need to talk and point or write at the same time.

The part that goes in the mouth -- the mouthpiece -- is flat and V-shaped to be gripped with the molars of both sides, leaving room in the middle for the tongue to move, and a free path in between the front teeth for air to flow out of the mouth; two characteristics which are essential for talking. Also, it is important to note that leaving the tongue free to move makes swallowing easy.

The two prongs of the flat V-shaped mouthpiece are tapered in thickness to the end, following the natural bite angle. This tapering eliminates a concentration of pressure that would otherwise occur when clenching the mouthstick between the maxillary and mandibular molars.

The prongs are covered with soft plastic sleeves for better grip and comfort.

The mouthpiece is the basic element to which our standard telescoping mouthstick "body" or other "bodies" for special purpose are attached.

To extend or shorten his mouthstick, the user first cranks loose a small lever that locks the mouthstick length. He then does the telescoping by shaking the mouthstick held in a downwards position, or by means of a telescoping aid, a fork-like friction device that mounts on a stand.

Then he cranks the lever tight to lock the mouthstick in the extended position.

An optional feature of this mouthstick is a mechanism for independent interchange of implements. With this arrangement, the mouthstick user can interchange from an eraser tip to turning pages...to a pen for writing notes.

The pen is held at the end of the mouthstick with an inclination similar to the way a pen is normally held with the hand. The inclination makes the tip of the pen visible for instant feedback of one's writing.

The implements, such as eraser tips, brushes, etc., are inserted in thin-walled aluminum cylinders which fit snugly on the pen or mechanical pencil, or in the plastic caps of a commercially available erasable-ink pen, which is an integral part of the mouthstick.

The caps and the aluminum cylinders, with their implements inserted, are kept in this Docking Holder when not in use, ... use picked up as needed.

The modular design of the system allows for custom fitting to individual needs. The Docking Holder can be combined with a bracket that mounts on the edge of a desk or lapboard, or with a pedestal that mounts on any flat surface.

New implements are being created for use with the system, such as a hook used to interchange floppy disks of a computer, or daisy wheels of a typewriter or printer.

2. Turntable Desk

A turntable as a desk is ideal for persons with limited reach. It provides easy access to a number of things by just rotating it.

The turntable, which is supported by precision balanced ball bearings, is easy to turn, ... even when heavily loaded.

These desks have been designed modular to fit individual needs. The legs are extendable for height adjustment. Extension tables, for extra working surface, can be attached to either side of the desk.

One Extension Table makes our Single-Turntable Desk in an "L" shape. A second Extension Table extends the length of the desk and makes it "U" shaped. The extended desk can then accept a second turntable that can be placed on top.

The resulting desk, composed of four modular sections, makes a highly functional workstation for the wheelchair-bounded student, clerk, or business man.

On one turntable, one can have files and other reference material. On the other turntable, there could be a computer with some more extra space left for additional files. The telephone is accessible on the Extension Table next to the files and the typewriter, which is also a letter quality printer, could be on the other Extension Table, next to the turntable which has the computer.

Being on a turntable, the computer is also accessible to a secretary who can sit in front to take dictation.

For extreme cases of weakness or paralysis, electric motors can be incorporated to do the turning. An easy to install motor kit for each of our Turntables-Desk models is available. The user can operate the motors by means of a sensitive micro-switch control box we provide with the kit.

3. Swing-Away Portable Desk

Next to my mouthstick which is my "hands", and my power wheelchair which is my "feet", a Portable Desk I carry on my wheelchair everywhere I go has been a most useful piece of equipment.

The portable desk is designed to provide wheelchair users with the convenience of an organized mobile workstation. It is basically a box whose to is used as a working surface, and slides to either side, or lifts open, thus making accessible the things a quad may carry in its interior, such as a dictionary, tape recorder, papers, etc.

A folding ramp is used for sliding objects to a higher surface, like a Turntable Desk.

Mounted on a single telescoping arm, the Portable Desk can be raised or lowered, placed over or under the arms of the user, closer or further away to suit individual needs, and can also be swung away.

The motorized version gives freedom and fun to high-level quads. For example, leg positioning can be checked by swinging the Portable Desk away.

"I have had great fun carrying my little niece on my lap-board. She likes to see how I work on my computer, and she is of great help by being my hands."

4. Stick-On Key-Lock

Computers are the perfect tool that give the handicapped easy access to gainful employment. Some difficulties have yet to be overcome, however.

Mouthstick users, for example, need some kind of solution to the problem of not being able to hold one key while pressing another. Stick-On Key-Locks are a solution.

These keylocks allow one-handed or mouthstick users to depress two or more keys of a keyboard simultaneously.

The keylocks, designed as a lever with two inclined planes at their tips, are moved, by hand or mouthstick, over the key in order to depress it. The key then remains depressed until the keylock is pushed back.

The base of the keylock comes with double-sticky tape on its bottom. It is to be stuck next to the key is going to lock, directly on the keyboard or on an overlay which some computers may require.

For some computer models, one Key-Lock can operate two adjacent keys alternatively, such as "CONTROL" and "SHIFT" on some computers.

5. Easy-Load-A-Diskette System

It is a set of simple and inexpensive aids which allows frail hand and mouthstick users to interchange floppy disks quickly and unassisted.

One aluminum tray is attached to each disk drive. The tray is used for the user to lay a floppy disk in position for proper feeding into the disk drive.

Wire hangers, which attach to each floppy disk, allow the disabled user to transfer the disks from a storage case to the tray on the disk drive, or vise versa, by means of a specially designed hook.

6. Typewriter-Printer With Paper Loader For Quad Operation

For office work, loading paper into a typewriter or printer is such a frequent job that soon merited a mechanism to do it unassisted.

A paper loader was designed for a line of electronic typewriters made by Brother. To feed paper into the typewriter, the sheet is first placed on the transparent platform.

This is done by means of a specially designed paper tray equipped with a folding-ramp. The tray has room for an adequate supply of typing paper, envelopes, cards, etc.

Once the paper has been placed properly, the transparent platform is lifted and the paper is automatically fed into the typewriter. Any type of stationary can be fed with the system, such as carbons, envelopes, cards, etc.

But the paper loader was not the only adaptation required for independent use of a typewriter by a mouthstick user.

The typewriter is tilted for better visibility. It is a single element machine, and by tilting it, the handicapped operator can more easily see what he is typing.

The levers that are moved for securing the paper in position needed extensions. The push button mechanism used for releasing the platen needed a lever and locking device. This feature allows for fine vertical line adjustments. The knob used for "manually" turning the platen also needed an extension. The "Control" key needed a key-lock for operation with a mouthstick. A couterweight was added to keep the lid open while interchanging printing elements with a mouthstick.

Now, it can be said that there exist no true obstacles for full typing capabilities by severely handicapped persons.

7. Blanket Remover

Knowing how much to cover myself when going to bed was a problem for a long time until I had two pieces of equipment made and installed: a window opener and a blanket remover.

A motorized window opener helped diminish the problem. This way I had some control of the temperature in my room by opening or closing the window at will.

This approach works relatively well in winter. However, it is ineffective on warm days where the outside temperature is about the same as that inside.

The problem was finally solved when I had an electromechanical device installed to remove or replace a blanket. The device is basically like a motorized looped clothesline extending a few feet above my bed lengthwise from wall to wall.

An aluminum tube with a length equal to the width of the bed was used like a trapeze suspended on two cords.

A blanket, 74 inches wide, was folded lengthwise and hooked on the aluminum tube.

Notice in the drawing that the bed is separated from th wall and also that one of the pulleys is substantially lower than the other. This arrangement allows for the blanket to be high against the wall when not in use and to cover more fully when being used.

Now I can go to sleep in piece, knowing that I will not have to suffer from cold or heat, or have to call somebody in the middle of the night for adjustments.

8. Tongue Operated Telephone Arrangement

A means to place a telephone call from my bed was required. Available sip and puff, single switch, etc., systems for dialing numbers are expensive. The telephone company offered and installed a single-switch system to access the operator. The device consisted of two electronic boxes connected to a speakerphone, and a tongue-operated switch. Rental for such equipment was around $12.00 per month, and it broke twice in the first two weeks of operation.

I returned the equipment and purchased a seven dollar push button telephone. A bracket was made to hold the telephone in a standing position by my face in my sleeping position. A cam-type mechanical switch allows me to turn the telephone on or off. The device was attached on the metal plate where I have the micro-switch box I use to operate the window opener and the blanket remover. The telephone, as well as the micro-switches, are within reach to fully operate with my tongue.

The total cost of custom making the device plus the cost of the telephone itself was less than $100.00. It works fine. I have used it for almost two years and it had never failed. Another advantage of this arrangement is that it is simple, small and easy to replace in case it breaks.

Concluding Remarks

Being a consumer of my own creations has given me the unique opportunity to fully test a new device before marketing is considered. My choice to become an engineer was a good one; and I encourage others to pursue their career desires in spite of their handicaps ...especially if they have the opportunity of having their functional needs resolved (through equipment?).

References

The following articles describe the development of this equipment:

1. "Quad Engineer Puts Talent to Work", Responaut (English Rehabilitation Journal), Sept. 1972.
2. "Engineering", Rehab. Gazette, 1972/Vol. XIV, pp. 32-33.
3. "Liaison Engineer", Rehab. Gazette, 1975/Vol. XVIII, p. 17.
4. "Preparing Quads for Independent Living", Reh. Gazette, 1976/Vol. XIX, p. 31.
5. "Custom-Designed Office for a Mouthstick User", Rehabilitation Gazette, 1978/Vol. XXI, pp. 38-39.
6. "Functional Independence for High-Level Quads with a 'Talking' Mouthstick and 'Peripheral' Equipment", Proceedings of the 5th Annual Conference on Systems and Devices for the Disabled, Houston, 1978, pp. 66-69.
7. "The Heyer-Abadie 'Talking' Mouthstick", Proceedings of the International Conference on Rehabilitation Engineering, Toronto, 1980, pp. 344-347.
8. "Equipment Makes the Difference", Proceedings of the 6th Annual Conference on Rehabilitation Engineering, San Diego, 1983.
9. "Creating New Avenues For Independence", Paraplegia News, Sep/1983, p. 58.
10. "Five New Pieces Of Equipment For Quads", Proceedings of the 9th Annual Conference on Rehabilitation Technology (RESNA), Minneapolis, 1986.

Tactile Graphic Braille Display

David Jaffe
Palo Alto VA Medical Center
Palo Alto, California

Problem

Computer access is a necessary prerequisite for many vocational and educational tasks today, and this trend is likely to increase over the next decade. It is estimated that by the year 1990 as much as 90% of all jobs will involve some interaction with a computer. A major component of this expanded role of computers will be the increased use of graphics to convey information (e.g. graphs, pie charts, or icons). These displays pose a potential problem for visually impaired individuals since there is currently no way to present graphic computer information to them. Without access to graphic data, visually impaired people will not be eligible for the opportunities that this new technology creates.

Significance:

Given current technological trends, the necessity of blind individuals gaining access to computers is evident. Without such access, there will be little chance for many of these individuals to attain economic independence. This would have a direct impact on tens of thousands of blinded veterans and many more non-veterans. In addition, many visually impaired adults leave jobs because they feel that they can no longer be productive. Adequate computer access through a graphic display and other devices can reduce the number of these "early retirees". The goal of this project is to assemble the necessary technology to construct an inexpensive tactile graphic display in an attempt to significantly improve the educational and vocational opportunities for thousands of blind and visually impaired people.

Background

The most common means used by the visually impaired to access computers are synthetic voice, single-line refreshable braille displays, hard-copy braille printers, low vision aids, and large print computers. Although each provides some measure of computer access, they all have shortcomings. Synthetic speech output from computers is an inexpensive means of attaining access, however, it does not allow access to graphic information. Single line, refreshable braille displays are expensive (e.g. $2000 per 20 cell display consisting of 3 rows of 40 pins) and, like synthetic speech, do not provide access to graphic information. Hard-copy braille printers do provide access to two-dimensional graphic information, but their slow printing speed is not efficient in interactive situations. Large print computers currently allow access only to alpha-numeric information. Low vision aids can be used by some partially sighted individuals to access conventional graphic displays; however, they are effective for only a small percentage of the visually impaired population.

Hypothesis

The project investigators propose that an electro-mechanical device can be developed that would display tactile braille, letter outlines, and graphics. This display, consisting of a matrix of plastic pins that can be raised or lowered under computer control, would be connected to a standard computer as its output device. It would be a functional substitute for the CRT display system used by sighted computer users. Visually impaired individuals would then have equal access to standard graphics software and could compete for jobs and succeed in education situations that require the use of graphics-based programs.

Approach

The American Foundation for the Blind (AFB) has recently designed a prototype graphic braille display mechanism which is thought to be suitable for presenting graphic and alpha-numeric information. The current project will allow continued work on that display, the development of companion software, and evaluations of the display in both laboratory and field testing situations.

Software development is being accomplished at a Rehabilitation Research and Development Center and focuses on providing a transparent interface to commonly available computers such as Apple and IBM product lines. The research combines the AFB hardware and VA software with concurrent evaluation so that the design process can immediately benefit from information obtained in the evaluation process. This will be facilitated by the initial construction of three prototype displays which will allow two displays to be used in the field and laboratory testing and the remaining prototype to be used for hardware refinement. The three units will be rotated from the AFB to the Western Blind Rehabilitation Center, so that advances in hardware are immediately incorporated into the evaluation process without the loss of time typically encountered when a solitary prototype is returned for repair or modification. Upon completion of the project it is expected that the display, with application software, will be sufficiently advanced and tested that it can be turned over to a manufacturer.

Status

Currently, computer interface hardware has been procured and some initial programming has been accomplished. Continued development of the prototype mechanical braille display mechanisms is underway, with arrival of the first working units from the AFB expected in mid 1986. At that time, an additional effort will be required to mate the electro-mechanical mechanism to a standard computer. Evaluation of the completed system will begin at that time.

References

Goodrich, G. L., "Application of Microcomputers by Visually Impaired Persons", Journal of Visual Impairment and Blindness, pp. 408-413, November, 1984.

Goodrich, G. L., Maure, D., Melrose, S., Jaffe, D., Schrier, E., Stevens, M., "Development of a Graphic Braille Display", Rehabilitation R & D Progress Reports, pp. 157-158, 1985.

Adaptive Positioning

Dennis Kviz
Compute Able Network
Portland, Oregon

The First Prerequisite to Maximum Computer Functioning

Because of neurological or orthopedic problems, many physically impaired people need careful positioning to prevent deformities and increase the person's capacity to work, learn, recreate, and improve their general state of health. Proper attention to positioning will allow an individual to realize their full potential by freeing up the body to cooperate most efficiently in the performance of a task.

Microcomputer operation requires not only the performance of a physical task but also cognitive functioning. Poor positioning not only causes difficulty in the physical operation of the computer, but also seriously interferes with attention span, mental alertness, and causes early fatiguing.

A very careful individualized approach must be utilized in order to insure that each person is positioned in such a way as to improve their ability to be productive. This is true with all individuals whether or not they have a physical impairment. However, when a person has a physical disability, their position becomes a much greater determining factor in their ability to function. Many clients expend a great deal of energy just trying to stay in their wheelchair, maintain their balance, or stay in a midline position. This generally increases tone, making other voluntary movements difficult and causing fatigue. Proper positioning and support allows the person to regain the use of some portion of this compensatory energy consumption, and re-channel it into more productive usage.

Therefore, the first consideration before putting a client on a computer is a proper evaluation of their needs, which must include the appropriateness of their positioning. Doing so will decrease the frustration level for both the client and the trainer, and in fact may allow someone to be successful who otherwise may have had their training stopped or eliminated from any initial consideration.

Proximal VS Distal

There are an enormous variety of seating or positioning difficulties that present themselves within the population of the physically impaired. It is imperative that a system be established for the proper evaluation of the persons needs based on the root causes of these deficits rather than the expressed manifestations. Most often a recognized problem is perceived to be specific to a body part or area. For an example, let us take a case of a client with excessively high tone in the hand and lower arm, making it difficult or impossible for him to utilize his hands to operate a keyboard. The usual approach is to either work with the hand by trying to reduce tone or attach a device to the hand to be used to activate the keys. This is referred to as a distal approach.

Distal refers to portions of the body that are away (or distant) from the midline position. High tone can be caused by the clients efforts to gain stability. With persons who have motor problems due to central nervous system deficits, generally the distal manifestation is caused by a proximal (near the midline) deviation. The most proximal portion of our anatomy is the spine. The spine is heavily influenced by the position of the pelvic girdle.

Imagine the pelvis as the critical cornerstone of the foundation for the rest of our skeletal framework. This skeletal framework is the undergirding for the musculature we rely on so heavily to perform our every day tasks. The proper positioning of the body in order to maximize performance is called ergonomics. When working with persons who have motor impairments and/or skeletal deformities we refer to ergonomics as "adaptive positioning". Adaptive positioning is the act of making compensatory adjustments i the way the body is supported so as to maximize the persons ability to perform tasks accurately and for long periods of time.

Evaluation

The evaluation needs to be done with a great deal of care. Individual client differences require proper attention by professional staff who are experienced in meeting the specific needs of persons with motor impairments. The best method is to put together a team of experts who are experienced in adaptive positioning. This team should include an occupational and/or a physical therapist, speech pathologist and teacher or trainer.

We must first start with the critical cornerstone of the skeletal foundation, the pelvis. Proper alignment of the pelvis can have a dramatic affect in the over all tone of the muscles and the ability of the person to improve their performance. The pelvis is attached to the spine in such a way as to provide movement in a great many different directions. The most common deviations observed are:

posterior tilt, the front of the pelvis tilted up towards the face. (See figure #1)

anterior tilt, the back of the pelvis tilted towards the back of the head. (See figure #1)

lateral tilt, the pelvis is tipped either to the left or the right. (See figure #2) rotation, the pelvis is rotated so that one side is forward of the other. (See figure #3)

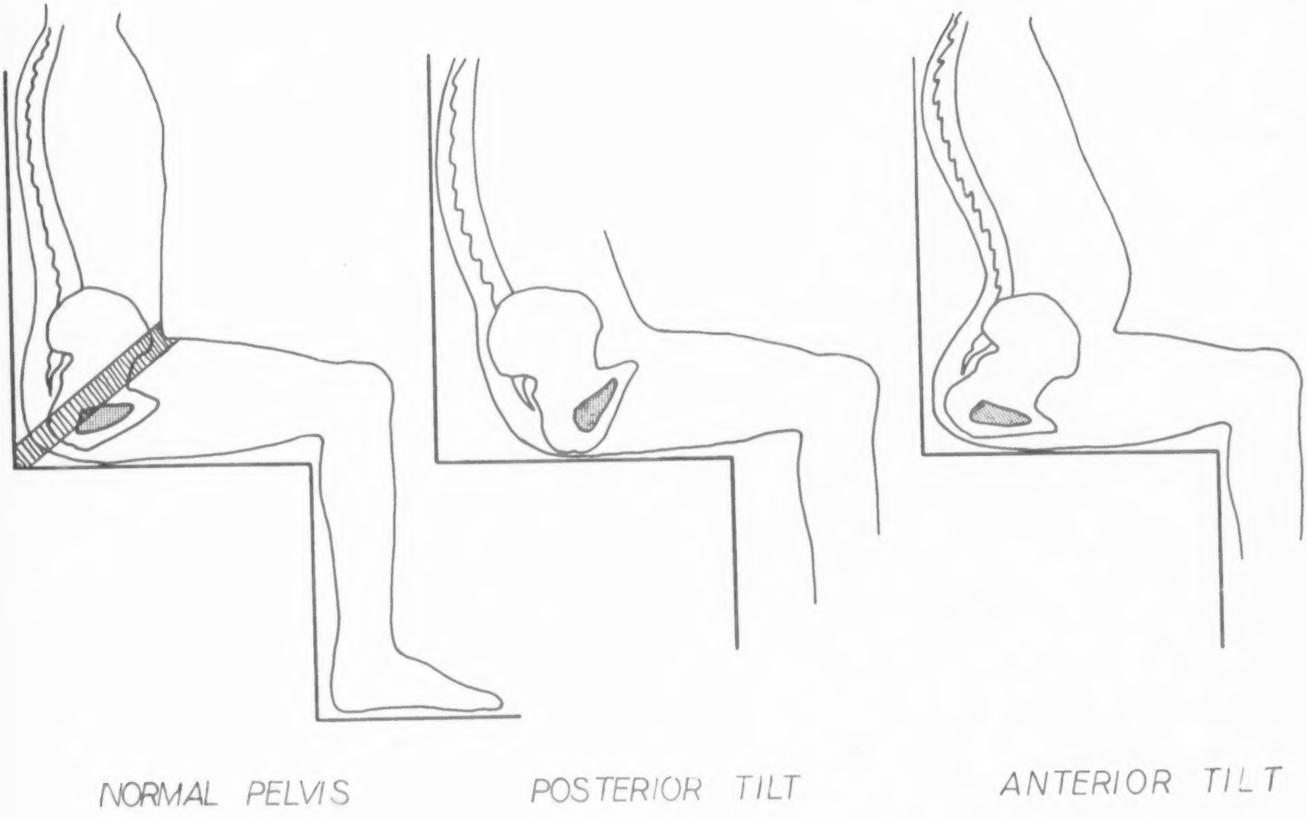
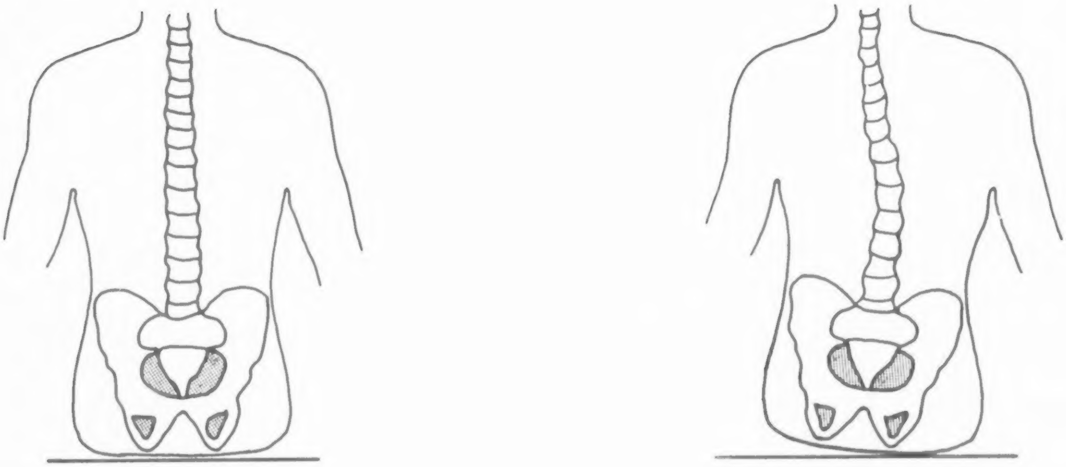

NORMAL PELVIS
POSTERIOR TILT
ANTERIOR TILT

Figure 1



NORMAL PELVIS LATERAL TILT

Figure 2

NORMAL PELVIS ROTATED PELVIS

Figure 3

In reality, it is most likely to find the pelvis in a position where more than one of the above deviations is present, which greatly complicates the evaluation. The pelvis requires a firm yet comfortable surface to provide a base of support while reducing the posibilities of discomfort, pressure sores, or skin breakdown.

Unfortunately, sling seats which come as standard equipment on most wheelchairs provide very poor support, reduce circulation, and encourage lateral tilting. Overly thick and soft seat inserts, although apparently very comfortable, provide very little stability. They can be compared to sitting on a water bed or a beach ball. It is very difficult to maintain the pelvis in the correct position. Once the pelvis is placed in a proper position on a solid comfortable surface, it needs to be properly secured so it will stay in this optimum position. This is best done by the utilization of at least a 2 inch wide belt presented at exactly a 45 degree angle across the hips and secured at the width of the hips. (See figure #1) The belt should be attached firmly enough to provide adequate support but not so tight as to restrict circulation.

After the pelvis has been well positioned the rest of the foundation must be evaluated and properly positioned before moving to the trunk. The legs and the feet comprise the balance of the foundation which provides support to the rest of the body. The legs must get support along the entire length of the upper leg, but not touch the back of the calf. The hips need to be positioned so they are at a 90 degree angle. If the person has high tone in their legs which causes their legs to pull towards each other (adduction), then an abductor of the proper size needs to be provided which keeps the knees properly spaced.

The feet need to be provided with adequate support at the proper height so that they are not dangling or causing the hips to be overflexed. The knees should be positioned so that they are at a 90 degree angle. The feet should be strapped in place only if they will not stay in place by themselves after the pelvis and legs have been properly positioned. Care needs to be taken not to strap the feet so tightly that circulation is interfered with.

Now that the foundation has been established, the next areas that need to be attended to are the trunk and shoulders. Scoliosis (curvature and rotation of the spine) is a major consideration when providing support to the trunk. Lateral supports to the trunk should only be used when necessary. The supports need to be very carefully positioned so as to provide just enough support but not to restrict respiration or upper trunk control. Too much support can also make the client dependent on that support. Another method for supporting the trunk and shoulders is the use of a trunk harness or H strap. Care must be taken to secure these types of supports so that undo pressure is not applied to the shoulders or to the diaphragm area.

Positions Other Than Sitting

The sitting position does not give every client the best possible control of their body. Clients who have severe to profound manifestations of central nervous system disorders or who have serious deformities may benefit from a number of alternative positions.

Fortunately, for the person who requires an alternative position, the microcomputer works equally well irregardless of its position in space. The increased ability to function greatly enhances the clients potential to utilize the computer.

Sidelying is one of the most beneficial positions for clients with high extensor muscle tone, serious asymmetries, poor head control, and with very low muscle tone. This position can reduce extensor tone, reduce the effects of gravity for persons with low tone, and help to bring the hands together in midline within the visual field.

Prone standing or lying provides a number of advantages for clients including greater elongation of muscle groups in the shoulders, trunk, hips, and knees, and freeing up the hands for purposeful activity. This is a good alternative position for clients who sit as their main position. Prone positioning must be used with a great deal of care as it can be fatiguing especially initially. This position is not recommended for clients who have poor head control or problems with hip dislocations.

The supine position is especially useful for clients who have athetoid cerebral palsy because it reduces excessive extensor tone. This position is also very useful for clients with poor head neck and trunk control. As in other positions careful attention must be made to ensure that the client is properly supported.

Once the client has received the best in gross motor positioning we can begin to properly evaluate the client's fine motor skills and configurate the microcomputer system that best meets the client's true motor capabilities.

Software For The Atypical And Severely Handicapped Student

Jude Curtis Levine
Marin County Office of Education
San Rafael, California

Abstract

The "Basic Skills Keyboards" program was designed for atypical and autistic students. Pilot work with elementary and high school age students has shown that it is useful: a) with students lacking prerequisite skill for independent use of commercial software; and b) with students demonstrating "Gestalt" cognition as described in current literature on autism. Use of the program increased the students' attention; response rate; intentionality; problem solving; and referential communication. It also served as an effective stimulus for social interaction; pragmatic communication; and behavior change. The program incorporates design characteristics patterned after recommendations found in the literature on autism. It was designed by a public school special day class teacher using a single-stroke Terrapin Logo keyboard. Prototypes of supplementary curriculum materials which reinforce learning and shape independent functioning exist.

The "Basic Skills Keyboards" program borrows the high-impact visual display; the flexible graphics; and the simple programming techniques of Terrapin Logo to create a do-it-yourself stimulus-response tool for teachers. Anyone with beginning knowledge of Terrapin turtle graphics can individualize the program to fit his or her own needs.

Designed by a special day class teacher working in a severely handicapped public school classroom, it has proven useful with students who lack the cognitive, attentional, and behavioral prerequisites necessary to use commercial software. It has also served as a successful stimulus for shaping social interaction, pragmatic communication, and behavior change in both low and high functioning students. Its usefulness as an independent pre-vocational task is being explored.

The "Basic Skills Keyboards" program provides a learner-centered experience in which:

1. The teacher pre-programs all the graphic stimuli.
2. The student operates the keyboard independently.
3. The teacher facilitates the student's performance as needed with visual, verbal or physical prompts.
4. The student makes responses which are characterized by progressive improvement in the areas of: attention; response rate; intentionality; problem solving; and referential communication.
5. The teacher alters the keyboard as needed to facilitate the desired behavior changes in the student.

A variety of game files exist for the user to choose among. Each has its own distinctive set of graphics laid out in its own distinctive pattern. The various visual displays currently available are: color screens; lines of various types in graduated size sequences; simple representational shapes; geometric shapes; letters; numbers; and filled-in blocks. Any one of these game files can be edited by anyone on the spot to accommodate or challenge the users' response pattern.

Rationale

Most available software assumes that:

1. The user can discriminate, remember and choose target keys as needed.

2. The user can comprehend and follow teacher's auditory directions.

3. The user can solicit help as needed.

4. The user can conceptualize relationships among program elements.

5. The user can develop problem solving strategies.

Unfortunately, students with autism or similar learning needs are often impaired in most if not all of these skills regardless of their age. This is often true even in students who display isolated areas of high functioning that hint of high potential.

The "Basic Skills Keyboards" program is an experiential discovery program intended to provide such students with as optimal a learning environment as possible by circumventing the need for such pre-existing skills. It was designed to incorporate guidelines currently found in the literature on the cognitive deficit in autism.

As explained most clearly by two key ideas people in the field (Prizant & Schuler, in press), autistic individuals seem to exhibit a relatively inflexible mode of information processing. These researchers term it "Gestalt" processing, meaning to convey that autistic individuals treat information that comes in to them as a whole.

Autistic individuals appear to be unable to break information down into its component parts. As a result, they are unable to see relationships between the parts that make up the whole. They are unable to see how environmental factors affect the parts that make up the whole.

Because of this, autistic individuals are least able to function when they are expected to process stimuli which are ephemeral, part of an interrelated sequence that moves rapidly past them and is gone.

And yet, as Prizant and Schuler point out, most subtle communication and socialization requires the capacity to quickly analyze and respond to such fleeting sequences. And, in the experience of the author, all too often so do the learning stimuli most readily available to special educators for the purpose of direct instruction, especially at the computer.

In their recommendations for remediation, these authors suggest the following strategies:

1. Present students with whole, static sequences spread out in space.
2. Generate authentic interest in the student.
3. Make the activity learner-centered; not teacher imposed.
4. Teach a skill that has functional value i the immediate environmental culture.
5. Present such consistent, clear responses to the students' behavior that they are able to form hypotheses about what they are personally experiencing.
6. Incorporate the use of language to mediate continued growth in thinking skills and problem solving skills.

In their own work, both researchers are primarily focused on language acquisition and communication. However, it seems feasible that these same characteristics would be relevant to curriculum materials intended to enhance cognitive functioning in individuals with autism and in others whose learning needs appear to be similar.

The "Basic Skills Keyboards" program is an attempt to create a software program to do just that. It is intended to be used in an environment where adults see as part of their role the job of facilitating enhanced performance and thinking skills.

Operation

The operation of the "Basic Skills Keyboards" program is very simple. Each time a key is pushed, a graphic line appears on the monitor. Each key consistently produces its own particular pre-programmed graphic each time it is pushed within as particular file. The graphic image remains static on the screen until another key is pushed. Once another key is pushed, a new graphic either replaces or alters the original image, depending upon the complexity of the visual display.

There is no movement on the screen other than that directly caused by the student. The makeup of the "whole" image which appears on the screen at any point in time is completely determined by the specific sequence of keys which the student has chosen to hit. The student has complete freedom to look at this "whole" image as often and as long as desired, and to alter it whenever desired. In the process, the student becomes focused on the changes occurring as a direct result of his or her actions.

Thus, instead of being threatened by the changes, the student strives to gain increasing control of the changes. This develops a self-stimulated, sincere interest in "thinking about the parts". It provides the learner with vivid, static whole images to relate to. Yet, it changes the component parts of the images in a sequence of experiences so close in time, so non-threatening in delivery, that the learner has maximal opportunity to interrelate each new experience with what preceded and will follow. Thus, the learner has maximal opportunity to form hypotheses about cause and effect; change; agency; and the interrelatedness of the parts which make up the whole.

Development

The program emerged out of the author's three-year experience as teacher in a specially funded interagency project involving Marin County Office of Education and Marin County Community Mental Health Services.

The majority of the low-functioning teenagers who were served by this project fit the criteria for Subgroup 2: Primitive Autism, in the categorization schema described by Dr. Bryna Siegel and her associates in the Stanford Autism Research Project (Siegel, Anders, Ciaranello, Bienenstock, & Kraemer, 1986). These students functioned at a severely retarded level; displayed repetitive motor stereotypies; were largely preoccupied in their own world; and were spontaneously mute but were trained to make one or two word utterances involving a limited vocabulary in familiar contexts. In addition, they did not have functional independent object relationships.

In an attempt to increase the quantity and complexity of the students' independent object responses, the author designed two simple files to facilitate independent keyboard functioning on their part:

1. COLOR.GAME: Each keystroke changes the background color displayed on the screen.

2. DRAWING.GAME: Each keystroke lays down one brightly colored line extending from the end of the previous line against a black ground.

These files were programmed using a single-stroke keyboard format called Superturtle!!© which was designed by Dr. James Evans of Marin County as a tool to help teachers create their own keyboards easily.

The author used this as a prototype and simply attached the desired procedures for each graphic stimulus to the selected symbol keys using the "C" or command procedure. Once that was accomplished for the entire keyboard, a name was given to that particular keyboard, and it was saved permanently to disk as a file, without losing or harming the original keyboard file which was used as a prototype.

Pilot Application

The hypothesis that these files would produce enhanced object interactions was tested out in an informal pilot study in a social playroom setting where these original students spent two 45-minute periods a day. They were given free access to the computer; were often invited to use the computer; and were supervised indirectly by an adult who remained at a distance except for intermittent prompts, helping interventions or direct verbal communications.

The duration of this informal pilot experience was only the last three months of the project, but it definitely gave evidence that using the computer in this way with such a population held promise. All the students performed more willingly, more independently and more competently at the computer than they had previously with any manipulative objects available to them. They displayed sustained interest; good visual focusing and tracking; and intermittent novel behavior. Their interest had not plateaued at the end of the time, but was still building. Examples of some specific student changes observed follow:

1. Baseline: Student A's spontaneous playroom language usage was limited to noun labels and "want (noun)."

At computer: Student A spontaneously initiated all of these phrases i a number of different sessions each: "me...lines" (directly adult's attention); "up... line" (descriptive); "line...(com)puter" (pointing); "lines on lights" (pointing to fluorescents); and "lines" (announcing his intent to walk to the computer to take a turn, which he would then do).

2. Baseline: When directed, student B usually remained at a distance from peers, staring into space, and tapping small objects on a surface below eye level.

At computer: Student B functioned independently for up to 15 minutes at a time, using varied finger movements; once he spontaneously approached and touched a peer at the computer on the shoulder and waited proximate for the turn he had thus initiated a request for; once he independently replicated with paper and crayon the simple design he'd just made on the computer after having been prompted to do so in previous sessions only twice.

3. Baseline: Echolalic and angry, Student C needed prompts to ask for help when he was unable to continue his task at structured manipulative sessions.

At computer: Student C spontaneously and loudly called "I want help" to adult at a distance from the computer every time he really needed help to continue.

4. Baseline: Oldest but lowest-functioning in the group, Student D was only interested in sensory properties of objects.

At computer: Initially, Student D refused to approach it. During the first month he was placed on a structured food reinforcement program. He would "poke" at the keyboard once or twice without looking at the screen for each food reward. During the second month, he began to look at the screen to watch for the effect and increased his key pushes to 10 or more per food reward. Early in the third month, he began to sit at the computer and concentrate on the screen as he pushed keys for up to 1.5 minutes per food reward. Toward the end of the third month, no further food reinforcement was necessary. He spontaneously sat down at the computer and focused intently on the screen while pushing the keys in a steady rhythm, for over 5 minutes each on two occasions, and for over ten minutes on another.

Further Development

At the end of this project, the author was assigned to a primary-level special day class in a community setting.

The population here was composed of verbal 8-to 14-year-old severely atypical students. Among them were students who met Dr. Siegel's criterion for Subgroup 1: Echolalic Autism, as described at the State NSAC conference at Stanford this spring. (Siegel, Anders, Ciaranello, Bienenstock, & Kraemer, 1986) They demonstrated verbal repetitions and ritualized play; lacked real imagination; and showed an increase in stereotypies with excitement. One seemed to meet the criteria for Dr. Siegel's Subgroup 3: Schizotypal Autism. This student had high functioning language, but was socially withdrawn, was anxious, and was driven by obsessive though processes. A few others seemed to meet the criteria for Dr. Siegel's Subgroup 4: Negativistic Autism. They were very difficult to shape; undermined behavioral programs; and were easily overstimulated by social contact. The remaining students showed various patterns of atypical retardation due to head trauma; seizure disorder; or the suspected presence of an uncommon medical syndrome.

Since these students were capable of functioning at a readiness to primary level in a parallel or adapted academic curriculum, there was a chance that the Basic Skills Keyboards program would be too simplistic and therefore useless. However, this did not prove to be the case.

The author devised additional files suited to their more complex level of functioning:

1. FIVE.FEATURE.FACE: Two five-key faces are laid out on each row with a black set providing an eraser for every6 feature.
2. THIRTEEN.FEATURE.FACE: One ten-key face is laid out on each row with a black row providing an eraser for every feature.
3. COLOR.SHAPE.MATCH: Three geometric shapes in each of three screen positions are laid out along each row, with a black row providing an eraser for every shape in every position.
4. UPPERALPHA: A white uppercase letter corresponding to the key pushed is drawn in the center of the black screen in correct stroke sequence.
5. COUNTING.GRID: There is a left to right pattern of ten small filled-in rectangles on each row.

Second Application

These game files were used selectively and intermittently with this population over a two-year period. All the students exposed to them in a relaxed manner with sufficient facilitation have consistently increased the variety, frequency and intentionality of their responses. All have moved to a level of increased dicision-making (they know what graphic they're after); increased prediction (they know where they think it is); and increased problem solving (they keep on looking even when they guess wrong).

With this population, new applications for the program emerged. It proved useful as a visual tracking stimulus; as a visual-motor imitation stimulus; as an introduction to the appropriate use of the computer; as a leisure-time reward activity; as a training activity for independent functioning; as a social-interactions stimulus for pairs of students; and as a safe outlet for overwrought students. It also provided an excellent transition into the use of the commercial word processing program, Magic Slate:

1. Baseline: Student E refused to let teacher direct or influence his key selection in any way and insisted upon following perseverative ritualized patterns.

At computer: After exposure to a structured shaping program in which desired visuals were used as reinforcement for compliance and exploration, Student E expanded his self-directed exploration to the entire keyboard. He successfully transitioned to the use of Magic Slate for imitating modeled full syntax.

2. Baseline: Student F was unable to replicate or imitate any kind of symbol sequence using any means.

At computer: After many uninterrupted sessions of exploration with various files, Student F successfully transitioned to the use of Magic Slate for imitating modeled three-letter words. She also discovered self-correction strategies and cursor movements independently without training.

In addition, the use of the program with this population stimulated the development of supplemental curriculum materials which provide practice in vocationally-relevant skills. These include:

1. A set of painted cardboard manipulatives in the same colors and shapes as the graphics in each of the game files. These are used to replicate the visual image from the screen onto the black basemat provided. Given such practice manipulating the changing elements as they are modeled on the screen, the student experiences making position; size; color; and shape discriminations at a self-directed pace. This reinforces the development of a working knowledge of ideas they cannot conceptualize.
2. A set of dotted-line printed models of the various screen options available in any one game file. These are used to reproduce given static screen images with corresponding color markers.
3. A set of picture-cued data sheets. These are used to record the absolute number of a graphic element displayed on a given static screen; or the number of sequential occurrences displayed in "x" number of turns or "x" amount of time.

Conclusions

The original hypothesis underlying this computer application was that students who had problems with cause-effect; means-end; and personal agency would develop a working knowledge of these relationships from experiences inherent in the program even if they remained unable to conceptualize these relationships. It was anticipated that generalization to other operations would occur because the student's sense of personal power, competence, and options would have been enhanced through doing.

It is proposed that adequate anecdotal evidence exists from the informal applications carried out to date to prove all claims make:

1. "Basic Skills Keyboards" program serves a directly useful remedial learning function itself.
2. "Basic Skills Keyboards" provides prototype for cognitive curriculum materials for autistic individuals and others with similar learning needs.
3. Gains from "Basic Skills Keyboards" carry over to other performance in the classroom besides the computer.

In order to test these claims further, however, two additional things are needed. First is a management system to collect data on each student's performance and provide summary reports of frequency, duration and patterns of response. Once this is added to the program, it will be possible to objectively measure the effectiveness of the program with the population described. I will also be possible to measure the effectiveness of the tool in primary prevention with very young children suspected of being learning disabled; language delayed; culturally deprived; or developmentally disabled.

The other need is for an operating system that would increase speed and ease of: (a) loading the program language; (b) selecting files; and (c) replacing files, while maintaining the flexibility of the on-the-spot editing capacity.

Once both these systems are in place, controlled trails in special day classes and select day care centers would provide valuable, definitive data about the usefulness of this tool as a remedial agent for students and children who have potential but are unable on their own to learn some of the requisite skills for developing it.

References

Prizant, B. & Schuler, A.L. (in press). Facilitating Communication: Theoretical Foundations. In D. Cohen, A. Donnellan & R. Paul (Eds.), *Handbook of autism and disorders of atypical development*. New York: Wiley & Sons.

Siegel, B., Anders, T., Ciaranello, R., Bienenstock, B., & Kraemer, H. (1986). Empiracally derived subclassification of the autistic syndrome. *Journal of Autism and Developmental Disorders, 16 (3)*, 475-492.

Low Cost High Tech:
People, Equipment, And Money Resources

Aimee Luebben
Washington University
St. Louis, Missouri

Abstract

The technology phenomenon, especially in the area of computers, is advancing at a rapid rate. Daily there are newer models, better versions, and smaller and lighter systems; these changes result in obsolete computer orphans. This is a reason that high tech is many times synonomous with the terminology highly expensive technology.

Society enjoys relatively inexpensive technology products made profitable through mass marketing, but disabled computer users are not so lucky. Technology from the general market must be examined to determine to what extent low cost high tech may meet the needs or be modified to meet the needs of disabled computer users. The emphasis of this paper is generic knowledge that may be applied toward any computer system and any disabled user. Strategies for implementing low cost high technology encompassing three general resource areas: people, equipment, and money are delineated.

Low Cost High Tech:
People, Equipment, and Money Resources

The technology phenomenon, especially in the area of computers, is exploding at a rapid rate. Daily it seems there are newer models, better versions, smaller and lighter systems, and, of course, systems with more features than ever before. The bigger, the better; the changes result in outdated, obsolete computer orphans. This is one reason that technology, often termed high tech, is many times synonomous with highly expensive technology.

While society enjoys relatively inexpensive technology products made profitable through mass marketing, disabled computer users are not so lucky. Technological products designed for individuals with special needs do not have similar profit margins and, while some products have been considered indispensable, if possible they should be avoided.

Technology from the general market must be examined to determine to what extent low cost high tech can meet the needs or be modified to meet the needs of disabled computer users. If there is no alternative but to utilize special needs products or systems, each product must be examined to establish the scope of the capabilities available for the present needs and the future potential for expansion.

The emphasis of this paper is generic knowledge that may be applied toward any computer system and any disabled user. Strategies for implementing low cost high technology encompassing three general resource areas: people, equipment, and money are examined. Methods of locating and forming liaisons with users groups, hackers, schools, universities, and libraries are discussed in the strategies for implementing people resources section.

Both computer software and hardware products are surveyed in the strategies for implementing equipment resources segment. Utilizing product reviews, search companies, and software rental companies to obtain and assess inexpensive commercially available software are delineated in addition to introducing the concept of and access to public domain and user supported software or shareware. Specific computer add-on boards for memory expansion, coprocessors, and other needs are addressed as well as various available peripheral enhancers.

The strategies for implementing money resources component addresses reimbursement for the individual as well as funding for facility equipment, the detection and location of grants, and the whys and wherefores of creative funding.

People Resources

One of the best resources in terms of information, expertise, enthusiasm, and often free labor is the computer users group. For the most part computer users groups are formed around a specific brand of computer; however, there are many theme users groups, such as computer applications for the disabled, artificial intelligence, etc. in existence. Specific computer brand users groups may be located through local computer stores, in the back pages of brand computer magazines, through specialized computer training facilities, in local computer newspapers, or by contacting computer companies. Theme computer users groups may be found through contact with the data processing departments of area business, industry, schools, and universities. Active membership in computer users groups can provide fast help to the panicked novice computer user and new ideas, adaptations, and expertise in both hardware and software for the intermediate and expert user. Both sides benefit: many times participants in computer users groups welcome a challenge or problem to solve. A sharing of resources, both knowledge and software for all levels of users, is the primary purpose for the formation and ongoing activities of these groups.

Individual computer enthusiasts, designated hackers, are often matchless resources. Hackers usually have computer programming or applications jobs and spend their leisure time hacking away at their home computers. Many times the promise of contact with people rather than monitor screens provides hackers incentive to spend free time and energy coordinating special projects for disabled individuals. Hackers may be located through contact with local computer stores and users groups, in the data processing departments of many local businesses and industries, and through messages left on local or national electronic bulletin boards. Young hackers may be found through schools and computer stores and Boy Scout Explorer Posts specializing in computers. The utilization of hackers of any age can provide the link between computer users with ideas and little expertise and the means for completing projects at very little or no expense.

Many times schools and universities are an untapped resource, particularly for software expertise. With the advent of many, inexpensive computer applications packages such as databases, wordprocessing, etc., some school and university computer instructors have been at a loss for ideas for coursework assignments. Many instructors welcome the opportunity for their students to work on extraordinary projects and this provides an inexpensive method for specific software product design. Product quality is usually excellent as the best design from the class competition for grades may be utilized. The instructors may be found through departments of data processing.

Because libraries provide access to information for the general public, many innovative libraries have installed computers, and sponsor and support computer activities. Friends of the library groups, library bulletin boards, student and adult library voluteers, and, of course, librarians can provide the basis for information of library computer activities.

Equipment Resources

In some cases when purchasing a computer system all the monies allocated are spent on computer hardware; and without funds to buy software, the once sought after and awaited computer remains in the box. In other cases there is such a rush to buy the equipment and software, that software packages, many times very expensive programs, do not suit the needs, the age level, reading level, or the purpose for which they were purchased. These white elephant software packages, tried once by a disappointed user, remain in the back of disk holders.

In terms of money there are three basic types of software: commercially available products, user supported or shareware packages, and public domain programs. Because each type has its own advantages amd disadvantages and price range, the three software types are examined separately.

Accurate and adequate information is the key to the purchase of ideally suited commercially available software. The most accurate method of gaining information about specific software packages is actual use. If actual utilization is a reality, user specific materials should be brought in and practiced as part of the demonstration. Computer stores are good resources for demonstrations of product lines carried, and usually have a supply of catalogs displaying those product lines not stocked. Users groups are another resource for specific software product utilization. Oftentimes the particular product may be owned by a users group member and arrangements may be made for utilization during trial period. The added benefit of having a person with background, experience, and expertise in the product readily available and the advantage of circumventing the pressure of a sales commission make users groups valuable resources.

Software rental companies are another way of having practical experience with a particular software product. Rental companies may be located in the advertisements of the back pages of brand or generic computer magazines. Since options and policies vary widely from one rental company to another, the return policy, rent to own option, and other procedures should be examined carefully before utilizing.

Search companies are another potential resource for obtaining the most suitable software package available. Companies vary as to size of software product database, charges, and discounts on software and should be scrutinized before a commitment is made.

Two search companies are SOFSEARCH, International, Inc., PO Box 5276, San Antonio, TX 78201, (800) 531-5955, (512) 340-8735 in Texas; and ITM, Software Division, 936 Dewing Avenue, Suite E, Lafayette, CA 94549-4292, (800) 335-3404, (415) 284-7540 in California.

When a particular software product is not readily available to try, a software review, while not ideal, may suffice. Software reviews may be located in printed media: brand name and generic computer newspapers, books, and magazines; and in electronic media. Three online electronic media resources are CompuServe, 5000 Arlington Centre Blvd., PO Box 20212, Columbus, OH 43220, (800) 848-8990 (614) 457-8600 in Ohio; The Source, 1616 Anderson Road, McLean, VA 22102, (800) 336-3330, (703) 734-7540 in Virginia; and The Knowledge Index of DIALOG Information Sources, 3460 Hillview, Palo Alto, CA 94304, (800) 227-1927, (415) 858-3785 in California.

The sheer numbers from which to choose the best suited program is the main advantage of commercially available software. The prime disadvantage for this category of software is the expense involved in the purchase and sometimes training.

The second type of software, user supported or shareware, is software packages made available in unprotected, copyable form. If the user finds the program useful, he or she has the option to send the suggested contribution to the software product's author. While the product may be used without monetary contribution, the user has the option of receiving update information and the opportunity to obtain the latest versions of the product with the payment of a one time sum. Shareware was a word coined by Bob Wallace, the author of PC-Write. Shareware offers a slightly different twist to the user supported concept: all original disks have a serial number and those individuals whose friends decide to register (make a monetary contribution). receive a flat fee for each registration from their disks' serial numbers.

User supported software includes command files and templates for commercially available products such as databases and spreadsheets, and complete, selfcontained software products. Documentation, thorough and many times lengthy, that is usually included on the disk and may be read and printed is one advantage of this type of software. Another advantage to user supported software is the ready availability of the program source code. This factor allows easy access to make modifications for disabled users. A third advantage is the ability to make direct contact with the author by mail, electronic mail, and telephone. Most authors will answer questions to problems and welcome comments for improvements to the software.

The one disadvantage to this type of software is the lack of generic products available, for at this time most user supported software is designed for the IBM computer. While this may be solved in several ways, the means is generally beyond the typical user's expertise. Of the products available many individuals speak of the Big Four; these include PC-Talk, PC-File, PC-Write, and PC-Calc. Many users groups make these packages available to their membership; if these are unable to be found, they may be obtained directly from their authors with suggested contributions. PC-File and PC-Calc, a database an spreadsheet package respectively, may obtained from Jim Button, PO Box 5786, Bellevue, WA 98006; the suggested contribution for each package is $45. Andrew Fluegelman of The Headlands Press, Inc., PO Box 862, Tiburon, CA 94920 is the author of PC-Talk, a telecommunications package; the suggested contribution is $35. PC-Write, a wordprocessing package authored by Bob Wallace, may be obtained with a $75 suggested contribution from Quicksoft, 219 First N. #224, Seattle, WA 98109, (206) 282-0452.

Public domain is the third type of software under discussion. By definition public domain is free software written by individuals who have no interest in selling the program, who have relinquished the copyright on materials that have sat on the shelves of computer stores, or who are government employees. While the main advantage of public domain software is the cost: these programs cannot legally be sold at a profit, there are some disadvantages. One disadvantage is the fact that the program are provided "as is" sometimes with some of the debugging left to unknowing users and little if any documentation or support by the author. Occasionally the author's phone is given along with user help for version updates, but these are rare cases. Public domain programs are available in virtually every category and most commercial programs have public domain equivalents. The best represented categories are utilities which have a short, limited focus and are designed to make life with a computer easier and more productive, the ever popular games, and extras which augment commercially available programs with templates, worksheets, etc.

Just as there are many different public domain programs, there are many different resources from which to obtain them. While local users groups have been discussed at length, many large users groups located in various areas of the country accept remote members who can obtain public domain software by mail.

Commercial firms, especially the computer companies such as IBM and Commodore, are good resources for public domain software. These firms distribute the software as a public service adjunct to their regular business. Often this resource is unnoticed because usually there is little if any advertisement of the products.

Another method of obtaining public domain software is to do so electronically. While there are connect charges associated with access to the public domain software libraries of CompuServe, The Source, and DIALOG, there are many electronic bulletin boards, both local and distant, that offer many of the same services. The OLCTD (Online Computer Telephone Directory). PO Box 10005, Kansas City, MO 64111-9990 contains one of the most accurate lists of electronic bulletin board phone numbers available; oe year's subscription (four issues) is $9.95.

Distributors provide another method to access public domain software. Since public domain programs cannot be sold, these companies charge a fee to cover the cost of the disk, postage, and handling. Buyers should beware: some distributors charge per disk, others per program. Disks ordered from those charging per program may add up to be quite an expensive proposition.

Three of many distributors are: American Software Publishing Company, PO Box 57221, Washington, DC 20037, (202) 887-5834; Almost-Free-Software, The Friendly Computer Shop, 78 Main Street, Littleton, NH 03561, (603) 444-2668; and Public Domain, Inc., 5025 S. Rangeline Road, West Milton, OH 45383, (513) 339-1725. All three distributors offer free catalogs.

Other sources include schools, public libraries, and educational consortia. Many areas have a local educational consortium; however, two which are readily available are SOFTSWAP, San Mateo County Office of Education (SMERC), Library and Computer Center, 333 Main Street, Redwood City, CA 94063, (415) 363-5470 and Minnesota Educational Computing Consortium (MECC), 2520 Broadway Distribution Center, St. Paul, MN 55113.

Many devices, particularly those manufactured third parties, are available to enhance and augment computer hardware. Whether by using the card and slot system or plugging into ports, many pieces of equipment designed for the general public may be used outright or adapted for disabled users. Computer add-on boards available include memory expansion, clocks, extra input/output such as voice recognition and speech synthesis, and coprocessors to add speed to the computer or the ability to run different software. There are many peripheral enhancers such as those to speed up disk drives, buffer printers, control the environment, as well as wrist terminals and running shoes to keep track of everyday life. The best way to locate and stay informed of available hardware enhancers is by reading the back of brand and generic computer magazines.

Money Resources

There are two categories for money resources for computers; reimbursement for individual disabled users and funding for facilities. For individuals there are many places in which to explore the potential of computer funding. Private insurance companies review each request and the determination is based on need, prognosis, diagnosis, and type of equipment requested. For private insurance companies the terminology of the medical prescription must be precise and if at all possible the term, computer, which is considered an educational not medical tool, be avoided.

Medicare considers computers educational and does not provide reimbursement; however, Medicaid funds assistive devices. Specifics may be obtained by contacting county or state Division of Family Services.

Vocational Education funds secondary, post secondary, and adult programs and will pay for computers utilized for training in approved vocational education programs. Contact the Division of Career and Adult Education for details.

Vocational Rehabilitation, contacted through the state Division of Vocational Rehabilitation, provides funds for high school seniors, adults, and school dropouts. In order to provide funding for computers, the equipment must be essential for the individual becoming employable after training, the system must be written into the individual's individualized written rehabilitation plan (IWHP), and the individual must qualify for vocational rehabilitation services.

The Bureau for the Blind will fund computer systems for legally blind individuals under the following circumstances: The individual must be a vocational rehabilitation client and the device must be used for nonschool activities.

Crippled Children's Services may be contacted through regional or state offices. This agency may provide equipment for individuals whose families meet financial requirements.

Computer funding for facilities may be obtained through grants and creative funding. Each state receives discretionary funds and decides how to disperse the funds; contact the Department of Elementary and Secondary Education and the Division of Special Education for details.

Many times private foundations are an untapped resource for funding. The Foundation Center, 888 Seventh Avenue, New York, New York 10106 (212) 975-1120, is a nationwide library network providing free access to funding information on 22,000 active philanthropic foundations. Call for the repository in the vicinity. The Council of Foundations, Inc., 1828 L Street NW, Washington, DC 20036 provides direction and information for the investigation of funding sources.

Many computer companies have special funds for computer system funding. Three such programs are: Wheels for the Mind, Apple Education Foundation, 10201 N. DeAnza Blvd. M/S 23U, Cupertino, CA 95014; Commodore Business Machines, Inc., Educational Division, 1200 Wilson Drive, West Chester, PA 19380, (215) 431-9100; and Tandy Educational Grants Program, 400 Tandy Atrium, Fort Worth, TX 76102.

Federal funds are yet another source of possible computer funding. While there are many federal agencies granting monies, two worth noting are the National Institute of Handicapped Research, Department of Education, Mailstop 3070-2305, Switzer Office Building, Room 400, Maryland Avenue W., Washington, D.C., (202) 732-1207; and Special Needs Section, Special Education Programs, Department of Education, Switzer Building, Room 4615, 330 C Street SW, Maryland Avenue W., Washington, D.C., (202) 732-1161.

Obtaining creative funding requires detective work, political savvy, and unwavering skill. A few leads in the creative funding quest include interviewing trust officers in local banks to learn the details of trusts, soliciting funds from local business or industry as part of community service or public relations, finding or starting a local or regional technology consortium, checking with the local chamber of commerce regarding the variety and service clubs in the area and each club's history of financial assistance for specific disabilities, and combing the State Directory of Organization Resources for the Handicapped available from each Governor's Committee on the Employment of the Handicapped.

Conclusion

With time and effort technology from the general market may be surveyed to determine the wealth of information and equipment resources available to disabled users. Specific strategies using people, equipment, and money resources to implement low cost high tech for disabled computer users have been delineated.

References

Glossbrenner, A. (1984). How To Buy Software. New York: St. Martin's Press.

Glossbrenner, A. (1984). How To Get Free Software. New York: St. Martin's Press.

Hagen D. and Hagen, B. (Eds.). (1986, April/May). 1986 Resource Directory. Closing The Gap, pp. 19-128.

Sloane, E. (1985, May/June). Funding News. The Sloane Report, p. 14.

Sloane, E. (1986, July/August). Not-so common funding sources. The Sloane Report, p. 3.

Software Analysis
For Educational And Clinical Utilization

Aimee Luebben
Washington University
St. Louis, Missouri

Abstract

There are many software programs designed to remediate specific sensory, motor, cognitive, perceptual, psychosocial, and life skills. Because the research and development costs are similar to those of mass marketed products and there are fewer consumers for the specialized products, the expense of such products is somewhat prohibitive for educational agencies, allied health clinics, and families of disabled individuals interested in the continuation of the educational or clinical program to the home. With the need for a less expensive solution, the L&J Software Analysis Checklist II was designed by an educator/clinician to critically examine and assess the therapeutic content of software for educational and clinical utilization. Any type of software may be analyzed using the L&J Checklist. This paper presents a discussion of the L&J Software Analysis Checklist II as well as strategies for locating inexpensive or free software, and methods of implementing a system of inexpensive software designed to improve various skills.

On the market there are many software programs designed to remediate specific sensory, motor, cognitive, perceptual, psychosocial, and life skills. While the research and development costs are similar to those of mass marketed products, there are fewer consumers for the specialized products. Thus the expense of such products is somewhat prohibitive for educational agencies and allied health clinical facilities, and even more so for families of disabled individuals interested in the continuation of the educational or clinical program in the home.

Originally specialized software was designed to be used at home daily or several times during the day by patients, clients, or students and the progress monitored weekly in the clinic or classroom. Today, in many cases the only use of therapeutic software takes place once or twice a week in a therapeutic or educational setting. Because the remediation of skills involves the learning process and learning occurs over many, short periods of time, the current methodology of school or clinical computer utilization falls short of desired expectations.

Seeing the need for a less expensive solution, the L&J Software Analysis Checklist II was created. The L&J Checklist was designed by an educator/clinician to critically examine and assess the therapeutic content of software for educational and clinical utilization. Any type of software, from a word processing program to an educational shape recognition program, may be analyzed using the L&J Checklist; even strategic or arcade type programs may be used.

The following discussion provides a delineation of the L&J Software Analysis Checklist II as well as strategies for locating inexpensive or free software, and methods of implementing a system of inexpensive software designed to improve various skill area components or individual skills.

The L&J Software Analysis Checklist II

There are three sections of the L&J Software Analysis Checklist II; the top component comprised of program specifics, the middle section composed of skill area components and individual skills, and the bottom component formed of other information. Each section is detailed in the following discussion.

The program specifications and hardware requirements are delineated in the top section. Users of the L&J Checklist complete the name of the specific software program; the author or manufacturer; and the software format of disk, cartridge, or cassette in the appropriate spaces. The details of the hardware needed to run and operate the particular program may be completed in the area marked hardware requirements. For example some programs are available for the same computer in cartridge as well as disk form, but the hardware requirements for each are very different. The cartridge format requires a computer and a monitor; however, the disk format requires a disk drive in addition to the computer and monitor.

Of prime importance, the second section is comprised of six skill area components: Sensory skills, motor skills, cognitive skills, perceptual skills, psychosocial skills, and life skills. Individual skills that constitute each skill area component are included in the subsequent discussion.

Eight skills: visual attention, visual discrimination, visual field, visual scanning, color discrimination, auditory attention, auditory discrimination, and rhythm sense comprise the sensory skills component. Visual attention is the ability to look at the screen, whereas visual discrimination is the ability to distinguish between two or more objects on the screen. Visual field refers to the ability to see all quadrants of the screen, and visual scanning is the ability of the eyes to track horizontally, vertically, and diagonally across the screen. Auditory attention refers to the ability to hear sound, and auditory discrimination is the ability to hear differences in two or more sounds. While it may be argued that there are two modes of rhythm sense, a sensory mode and a motor mode, the type of rhythm listed is sensory and is defined as the ability to recognize a pattern of sounds.

There are seven skills listed for the motor skill area component; they are single touch, multiple touch, object manipulation, hand-eye coordination, response time, midline crossing, and motor planning. The first three skills deal with the method of input; single touch refers to the ability to respond with one touch of a button or key, multiple touch to the ability to respond with more than one touch of a button or key at one time, and object manipulation to the skill and performance in handling such objects as a joystick, paddles, rollerball, mouse, etc. Of the last four skills hand-eye coordination is the ability to use the hand in conjunction with the eye, response time is motor output judged by length of time, midline crossing refers to the ability to cross the vertical midline of the body, and motor planning is the ability to plan and implement purposeful movement in a untried, novel situation.

Concentration, attention span, time estimation, auditory memory, visual memory, categorization, organization, sequencing, association, instruction following, action/consequences, problem solving, and decision making are the 13 skills that comprise the cognitive skill component. Concentration refers to the ability to focus on a task or concept, attention span adds the variable of time to task focus, and time estimation is the ability to judge time and variable lengths of time. Of the next three skills categorization is the ability to label objects, organization refers to the ability to sort objects into fewer, larger groups, and sequencing is the ability to place objects in logical order. Association refers to the skill of remembering a second object when reminded with a first object. Instruction following is the ability to understand and implement single or multiple directions. Action/consequences is ability to know which specific reaction will follow a particular action. Problem solving is a higher level cognitive function and refers to the ability to identify a number of solutions to difficulties, whereas decision making is the ability to make a choice of a number of solutions identified.

The perceptual skills component area is comprised of eight skills: form constancy, figure ground, pattern recognition, position in space, spatial relations, three dimensions, depth and distance, and topographical orientation. Form constancy is the skill of recognizing specific forms and objects as the same when presented in different contexts, whereas figure ground is the ability to recognize forms and objects when presented with competing stimuli; e.g., distinguishing foreground from background. Pattern recognition refers to the ability to perceive a recurring sequence in objects. While position in space is the skill of knowing one's own place in space relative to other objects, spatial relations is the ability to recognize forms and objects in relation to each other. Three dimensions is the skill of perceiving the horizontal, vertical, and extension of depth; depth and distance is the skill of judging size and area; and topographical orientation refers to the ability of perceiving the directions of north, south, east, and west in addition to distinguishing the right side of the body from the left.

Five skills constitute the psychosocial skills area component. They include: self control, self expression, self concept, situational coping, community involvement, and socialization. Self control is the ability to modulate, modify or initiate new behaviors in accordance with the situation at hand. Self expression refers to the ability to experience and recognize a range of emotions and interpret and utilize a wide variety of verbal and nonverbal communication skills. Self concept refers to cognitive image of one's functional self and includes perceiving one's own needs, feelings, conflicts, values, beliefs, goals, and expectations. Situational coping is the skill in motivating performance, managing time, handling stress, and solving problems. Community involvement refers to the ability to assume one's own role and interact within the social system of the family and society. Socialization is the ability to relate to another person.

Sixteen skills: feeding/eating, grooming, dressing, kitchen management, household management, financial management, shopping, business management, written communication, augmentative communication, environmental control, functional academics, survival skills, educational skills, prevocational skills, vocational skills comprise the sixth and last skills component area, life skills. Feeding/eating refers to the ability to feed oneself sequentially including using the appropriate utensils; grooming refers to the skill and performance in attending to personal health care need such as bathing, haircare, shaving, etc.; and dressing is the ability to choose the appropriate clothing and dress oneself in a sequential fashion including fastenings. Kitchen management refers to the skill in performing recipe handling, meal planning, nutrition care, and other kitchen tasks. Household management includes, but is not limited to, home inventories, cleaning schedules, and repair lists, whereas financial management refers to budgeting, banking, and tax preparation. Shopping is the skill and performance in preparing shopping lists, and includes conducting shopping expeditions via computer and modem. The ability to perform business application tasks such as accounting, filing, and typing are included in the business management skill. While written communication is the ability to relate using the written word, augmentative communication refers to the ability to use systems that enhance or provide communication of any kind. Environmental control is the ability to access and handle common objects such as light switches, doorknobs, curtain pulls, and appliances. Functional academics refers to basic arithmetic and language performance, whereas survival skills include, but are not limited to, the ability to understand road and building signs. Educational skills include computer assisted instruction (CAI), coursework, and completion of the requirement for degrees; prevocational skills include job awareness and vocational readiness performance; and vocational skill is the ability to perform a trade or profession.

The third section, the bottom component, lists the following areas for completion: modifications required, program strengths and weaknesses, primary and secondary skill area, age level, reading/grade level, date and evaluator. The modifications required area may be completed to include possible beneficial hardware or software changes; e.g., change the program speed to slow down. The area for program strengths and weaknesses may be used to stress specific advantages or disadvantages of the program; such as, the ability to change speeds or the existence of loud, offensive error responses. The primary and secondary skills area are included for cross referencing purposes: any of the six skill area components may be used to denote each program's primary and secondary skills area, or the 58 individual skills may be utilized. The age level area allows subsequent judgment of the age appropriateness of software and the reading level space was included to acknowledge literacy differences. The area for date and evaluator permits updates and continuity in the personnel evaluating the material.

Strategies For Implementation

Every assessment device requires appropriate materials for measurement; the L&J Software Analysis Checklist II is not an exception to this rule. In order to keep the costs of software as low as possible and also allow ready access for patients, clients, and students to improve various skill area components or individual skills at home, inexpensive and free software packages have been selected as the materials of choice.

Inexpensive software are those copyrighted programs or packages which may be purchased for less than $15. These packages may be found in large discount stores, at computer stores on closeout shelves, in pages of liquidation catalogs, and on commercials of cable television, to name a few sources. Sources of inexpensive software must be checked several times per month to locate bargains.

Another name for free programs is public domain software. This is software that was written by individuals who, for some reason, have relinquished the copyright privileges. One source of public domain programs is the computer users group; users groups may be found locally, regionally and may have been formed around a specific computer brand or a particular interest common to all members. Other good resources are commercial firms, such as computer companies who, with very little advertisement, distribute the free software as a public service. Electronic sources, the commercial databases and electronic bulletin boards, are another resource. However, if there are long distance charges and line charges involved, special care must be taken that the software remain inexpensive following the downloading procedure. Local educational consortia are another possibility of locating public domain software as well as a location for perusing software before purchasing. More local public libraries are including nonprint materials in their collections; one commonly found library material is public domain software. These are a few resources to utilize in the search of public domain software.

To implement a system of software utilized to improve various skill areas or individual skills, software must be gathered and analyzed using the L&J Checklist. Before formal analysis it is best to spend some time working with the program, then at least two evaluators should analyze each program and meet to discuss the outcome of the L&J Checklist for each program. This will allow a greater consistency of measurement.

The best method of storing the information on the amassed L&J Checklists is on a hard disk; however, if a hard disk is unavailable, the completed L&J Checklist for each program may be photocopied three to five times for cross referencing purposes. The topics or fields for cross reference include computer brand, primary skill level, secondary skill level, age level, and reading level; the L&J Checklists for each topic may be stored in a loose leaf binder for easy access. Following the evaluation of a new patient, client, or student and the identification of performance deficits, the appropriate field may be printed from the hard disk file or binder be investigated to match a program to the specific needs of the individual. If the program selected is public domain, the program may be legally copied and issued for home use if the individual has a computer.

Summary

The combined use of the L&J Software Analysis Checklist II and inexpensive or free software provides a solution to the dilemna of the prohibitive expense of software designed for special needs and allows the therapeutic remediation of sensory, motor, cognitive, perceptual, psychosocial, and life skills in the classroom, clinic, and home.

Appendix

L & J Software Analysis Checklist II

Program Name: ____________________
Manufacturer: ____________________
Computer: ____________________
Format: ☐ 5 1/4" Disk ☐ 3 1/2" Disk ☐ Cassette ☐ Cartridge
Hardware Requirement: ____________________

Sensory Skills

- ☐ Visual Attention
- ☐ Visual Discrimination
- ☐ Visual Field
- ☐ Visual Scanning
- ☐ Color Discrimination
- ☐ Auditory Attention
- ☐ Auditory Discrimination
- ☐ Rhythm Sense

Motor Skills

- ☐ Single Touch
- ☐ Multiple Touch
- ☐ Object Manipulation
- ☐ Hand-Eye Coordination
- ☐ Response Time
- ☐ Midline Crossing
- ☐ Motor Planning

Cognitive Skills

- ☐ Concentration
- ☐ Attention Span
- ☐ Time Estimation
- ☐ Auditory Memory
- ☐ Visual Memory
- ☐ Categorization
- ☐ Organization
- ☐ Sequencing
- ☐ Association
- ☐ Instruction Following
- ☐ Action/Consequences
- ☐ Problem Solving
- ☐ Decision Making

Perceptual Skills

- ☐ Form Constancy
- ☐ Figure Ground
- ☐ Pattern Recognition
- ☐ Position in Space
- ☐ Spatial Relations
- ☐ Three Dimensions
- ☐ Depth and Distance
- ☐ Topographical Orientation

Psychosocial Skills

- ☐ Self Control
- ☐ Self Expression
- ☐ Self Concept
- ☐ Situational Coping
- ☐ Community Involvement
- ☐ Socialization

Life Skills

- ☐ Feeding/Eating
- ☐ Grooming
- ☐ Dressing
- ☐ Kitchen Management
- ☐ Household Management
- ☐ Financial Management
- ☐ Shopping
- ☐ Business Management
- ☐ Written Communication
- ☐ Augmentative Communication
- ☐ Environmental Control
- ☐ Functional Academics
- ☐ Survival Skills
- ☐ Educational
- ☐ Prevocational
- ☐ Vocational

Modification Required: ____________________
Strengths: ____________________
Weaknesses: ____________________

__________ Primary Skill Area __________ Age Level
__________ Secondary Skill Area __________ Reading/Grade Level
__________ Date
__________ Evaluation

Aimee J. Luebben, MS, OTR/L
Washington University School of Medicine
Program in Occupational Therapy
4561 Scott, Box 8042

Contemporary Applications Of Computer Technology
Development Of Meaningful Software
In Special Education/Rehabilitation

Russell Mills
Brain-Link Software
Ann Arbor, Michigan

At the start of the decade when the microcomputer first began to find its way into classrooms and clinics, it became apparent that a 'revolution' was underway. We were promised that this new technology would revolutionize the way in which teachers taught and students learned. It would produce fundamental changes the ways in which diagnoses were reached and treatment methodologies were applied (Northern, 1986; Mills, 1986a). Now was we look back over the last few years of using microcomputers in special education and rehabilitation, we find that only some of these promises have been kept. While progress is apparent, it is clear that the current technology possesses many functional limitations which curtail its use as a revolutionary tool of rehabilitation.

In 1980 when this clinician began to experiment with the technology as a tool in aphasia rehabilitation, the 8 bit, 48K Apple II+ was state of the art. At that time there were few peripheral devices which were of particular use in rehabilitation. Over the years leading to 1986 there have been important advances in hardware development. Now 16 bit and 32 bit machines are common. A 48K microcomputer is not only passe', it is antiquated. Microcomputers with 20 or more times this memory are easily found. A wide range of peripheral devices including speech synthesizers, speech digitizers, speech recognition devices and touch screens have all become available and affordable (Mills, 1986b). However, while hardware advances have been monumental, serious limitations in the usefulness of the technology remain.

Microcomputer hardware selection is directly dependent upon software availability (Mills, 1986c). Without appropriate software a system can not meet the goals the teacher or clinician has set. It is in the area of software availability that the greatest limitation remains. When rehabilitative uses of the microcomputer first began there was no software specifically designed for this application. Existing programs in general education were 'borrowed' for use in language habilitation/rehabilitation. These 'generic' programs which were developed with the normal child/adult in mind often exhibited severe limitations when used to meet the needs of the language and cognitively impaired. Very quickly the need for software which could be adapted to the needs of the handicapped became apparent. However, few clinicians and teachers possessed the programming skills needed to develop sophisticated software. As a consequence, software development companies were created specifically to develop and market software dedicated to meeting the needs of teachers and clinicians. Brain-Link Software is one such enterprise.

It cannot be denied that in the past few years a wide range of programs have been produced. However, many of the programs produced continue to exhibit the same limitations which frustrated us when we first experimented with generic software (Volin, 1986). Few of the current dedicated programs contain all of the features which are needed to make them meaningful, flexible and useful. This is a particularly frustrating situation when it is recognized that many of our dedicated programs are produced by companies begun by teachers and clinicians. Only when the software consumer, teacher or clinician, demands more of the producers will more sophisticated programming be made available. In the end it is the consumer who will determine what is produced because software companies will not expend resources to develop programs which cannot be sold.

The remainder of this presentation will discuss the four elements of clinical programming which must be considered during development if the program is to be a truly useful adjunct to rehabilitation. These criteria govern the development of all of Brain-Link Software's products. Each of several products will be demonstrated and discussed.

Cardinal Features Of Meaningful Programming:

Presentation Of A Useful Task

The single feature which makes the microcomputer so useful to us is the fact that it is not dedicated to any particular function. Merely by the selection of software and appropriate peripheral devices the machine an be made to perform as multitude of functions. The functions selected for computerization must be ones which are meaningful to the educational/rehabilitation goals of the teacher/-clinician. He/she must analyze his/her clinic/classroom situation to determine which tasks would best be administered by the microcomputer. In many clinics funds have been expended to purchase programs which are well produced but do not perform useful tasks. Such programs go unused; a waste of resources.

Some clinical tasks lend themselves well to presentation by existing microcomputers; others do not (Mills, 1986b). Attempting to present a task for which the technology is not currently appropriate may well result in failure to learn and outright rejection of the technology by the child or adult. The most obvious examples are those where tasks are dependent upon sophisticated peripheral devices. Tasks which require that the computer understand the student/patient's spoken utterances are the best examples.

The single speaker recognition of speaker dependent devices and the limited vocabularies of speaker independent devices preclude their most powerful uses. In the near future these limitations will yield, but for the present any applications made must remain within the bounds of that which the technology can accurately and reliably perform.

Clinician Selectable Treatment Parameters

Many of the current generic and clinical programs provide the clinician with little or no control over treatment parameters. The best example is the typical video game which was developed to tax the skills of those with normal perceptual and motor systems. Most of these programs do not allow the speed to be slowed, accuracy criteria reduced or input device selected to accommodate those who are limited in ability. Consequently, the brain damaged are often precluded from using such programs.

This program rigidity is also present in any generic and dedicated clinical programs. To the teacher/clinician this means that a given program may be appropriate for very few students/patients. When it is useful for an individual, its usefulness will be quickly exhausted, either through improved performance or through boredom resulting from an inability to vary the demands of the program.

The programming provided by Brain-Link supplies the teacher/-clinician with extensive control of critical treatment parameters. This control greatly extends the program's usefulness within and across individuals and can be found in most of our programs:

Treatment Parameters	Function
Response Input	Keyboard, Joystick, Koala Pad
Baseline Selection	No Reinforcers Provided
Sound On/Off	Audio Indication of 'Right/Wrong'
Text Prompting	A Text Assist in Aud. Comp. Prog.
Clock	IIe users - Response Times Delay (0-3) Aud. Comp. Prog.-Reduces Rate of Speech Vis.+Read. Rec.- 3 Memory Intervals
Response Cont. Delay On/Off	Varies Rate of Speech or Delay Contingent on Response Accuracy
Data Collection On/Off	Disk Stored Data Coll/Analysis
User List	Disk Stored List of 10 User Names
Task Difficulty Level	From 3-11 levels per disk

Data Collection/Analysis

It is not uncommon to find generic programs which report only 'number correct'. Even some of the dedicated programs currently available fail to report more; a few even fail to provide printed data output. While the number correct is considered to be some indication of performance, it is not sufficient for the teacher/clinician who wishes to make treatment decisions based on performance in the computer based task. Porch (1967) has demonstrated the limitations of this type of '+/-' scoring. There are many variations of error responses and degrees of correctness. Particularly when the student/patient executes programs independently, it is necessary that extensive data be collected, analyzed and reported to aid in the clinical decision making process. Without adequate data collection the ability to document the value of much of computerized therapy becomes questionable.

Recognizing the importance of full data reporting to the clinical process, Brain-Link has aggressively developed some of the most extensive data routines currently available in clinical software. Programs produced by Brain-Link provide the following types of data to the teacher/clinician on the monitor screen or as printed output:

Patient name and Status of Treatment Parameters Selected
Date/Time Stamping (with hardware clock)
Record of Actual Stimuli Presented
Record of Actual Responses Produced
Number of Correct and Incorrect Responses
Number of Stimulus Repeats
Percent Responses (correct and incorrect)
Individual Item Response Times (with hardware clock)
Mean Response Times (correct and incorrect)
Standard Deviation of Responses (correct and incorrect)
Analysis of Visual Quadrants of Error (Visual and Reading Rec. Programs)
Statistical Summary Within and Across Treatment Trials

By offering these extensive data routines Brain-Link insures that its program will be able to make highly significant contributions in classroom, clinical and research settings. Where students/ patients function independently these data will allow appropriate and expedient clinical decision making. Where personnel resources are inadequate to meet the needs of growing caseloads, our program will allow individual attention to specific problems while addressing issues of cost accountability. We are convinced that it is in this direction that future software development must take us.

Authoring Capability

If 'Clinician Selectable Treatment Parameters' are provided they can add a great deal of flexibility to a program, thereby greatly extending its usefulness. However, this concept of flexibility can be advanced one more important step by the addition of an 'Authoring Capability'. When so equipped a teacher/clinician can edit existing stimuli and add additional stimulus files specifically geared to his/her students/patients. Authoring can be used to extend the difficulty range of the tasks available on a disk or to personalize files to meet individual needs.

The technology involved in some programs precludes the inclusion of authoring routines. Such as the case in Brain-Link's auditory comprehension series. However, where possible (Reading Recognition) Brain-Link has provided authoring which is easily learned and quickly executed.

A Demonstration Of Selected Brain-Link Products

Auditory Comprehension Programming

Brain-Link offers three programs designed for use in the training of auditory comprehension/auditory memory impairments. These are

Word Recognition (nouns), Function Recognition (verbs) and preposition Recognition (preposition concepts). All three utilize speech which is produced by speech digitization (Mountain Computer Supertalker). It is by this means that the clearest speech signal can be generated while allowing critical program manipulations such as variable rate of speech. These programs have been found to be useful in the treatment of adult language (Mills, 1982, Mills and Hoffer, 1986) and child language disorders and in cognitive rehabilitation.

Visual Perception/Memory

Our Visual Recognition program provides practice in the visual perception of colors, shapes, letters, letter pairs, letter trigrams and mirrored pairs and trigrams. Practice can be provided in a normal or memory mode. This program is useful for both children and adults where visual perception and memory are the focus of attention. Reading comprehension is not necessary for use of the program.

Reading/Memory

The name of the program Reading Recognition does not fully communicate its extensive range of applications. It is a program which is highly useful in many areas of language, and cognition with both children and adults in the home, classroom or clinic. Reading Recognition requires the user to match the central target with one of four choices located at the four corners of the screen. Items can be presented in a normal or memory mode. Often these items are words, but they may also be numbers or keyboard characters. The authoring system provided means that the applications are only limited by the clinician's imagination. The program is provided with 14 stimulus files of 20 items each. The editing routines will accommodate an additional 12 files for a total of 520 stimulus items. For independent use sequences of several files can be assigned with a few Keystrokes. Several of the possible files are; nouns-verbs, object-color, object-function, item-price, item-weight, company-product, keyboard character logic sequences, family member-name. Full treatment parameter control and data collection are provided.

Memory Patterns

This program which is marketed by Brain-Link Software, was produced by a neuropsychologist for use in cognitive rehabilitation. The task requires the patient to match a block design which is presented on the screen. Extensive control is provided to the clinician over critical parameters, e.g., number of blocks in the design, grid size, presentation time, retention interval, acceptable number of errors. In addition it will execute in an automatic or therapist assist mode.

Visable Speech Aid

This exciting product is marketed in the United States by Brain-Link Software. Produced by a Canadian company it brings usable speech recognition/analysis technology to the teacher/clinician at an affordable price. VSA is a hardware/software package which was designed for the Apple II+/IIe. It allows a visualization of tracings of pitch, amplitude and rhythm of spoken utterances. It provides disk storage for tracings and an entertaining game format for children. It has been found useful in deaf education and in articulation, voice and fluency training. While it is entertaining and stimulating for children it is also well accepted by adults.

Brain-Link Software believes that some of the most important applications for microcomputer technology in our society are being found as we address the needs of the handicapped. While the advances of recent years have been exciting and rewarding, it is clear that we have yet to realize the full potential of this technology. When consumers demand that software producers attend to the programming elements discussed in this presentation, then we will be nearer to the realization of fully applied technology.

Bibliography

Mills, R.H., Microcomputerized Auditory Comprehension Training, *Proceedings Of The Clinical Aphasiology Conference*, BRK Publishers: Minneapolis, 1982

Mills, R.H., Microcomputers In Aphasia Rehabilitation, In R. Chapey, (Ed.), *Language Intervention Strategies In Adult Aphasia*, New York: William and Wilkins, 1986.a.

Mills, R.H., Microcomputer Applications In Aphasia and Head Trauma, In J. Northern, (Ed.), *Microcomputer Applications In Communication Disorders*, Boston: Little Brown Publishers, 1986.c.

Mills, R.H., Peripheral Devices and the Clinical Microcomputer, In M. Grossfeld and C. Grossfeld (Eds.). *Microcomputer Applications In Rehabilitation Of Communication Disorders*, Rockville, Maryland: Aspen Publishers, 1986.b.

Mills, R.H., and Hoffer P.S., Computers and Caring, In R. Marshall, (Ed.), *Case Studies In Aphasia Rehabilitation*, Austin, Texas: ProEd Publishers, 1986.

Northern, J., (Ed.), *Microcomputer Applications in Communication Disorders*, Boston:Little Brown Publishers, 1986.

Porch, B.E., *Porch Index of Communicative Ability* (PICA). Palo Alto, California: Consulting Psychologists Press, 1967.

Volin, R.A., Considerations in the Design and Programming of Clinical Software, In M. Grossfeld and C. Grossfeld (Eds.), *Microcomputer Applications in Rehabilitation of Communication Disorders.* Rockville, Maryland: Aspen Publishers, 1986.

An Interactive Videodisc-Computer Language Program

R. Scott Osksa
California School for the Deaf
Riverside, California

Teachers have long faced the problem of locating motivating materials to teach language to hearing impaired students. The California School for the Deaf, Riverside has spent five years pioneering an interactive videodisc program to assist teachers in this area.

The project developed a system using the Apple II microcomputer system to superimpose language tasks upon video images displayed by a Pioneer laserdisc player. A sophisticated authoring program and interface card was developed for use with the two 27 minute videodiscs produced at the school by the project's instructional designers.

Two hundred language units were prepared for the field test. The equipment and software was improved and updated. The school opened one of the country's first complete interactive videodisc "labs", with eight systems to serve students from every academic department.

The California School for the Deaf, Riverside has served as one of the models of practical application of Interactive Videodisc technology for the past six years. Preparations have been made for the opening of one of the country's first fully equipped Interactive Videodisc labs during the fall of 1986. The lab will consist of eleven complete interactive systems and an extensive library of staff developed software capable of servicing entire classes of hearing impaired students from every academic department in the school.

History

The project was initiated under the direction of Robert K. Lennan, Superintendent of the California School for the Deaf.

Riverside (CSDR) in 1979. Using ESEA Title IV-C funds the project's instructional designers, Barbara A. Peterson and Rod J. Brawley, worked with Gary Galbraith, Ph.D., professor in the Department of Psychiatry and Biobehavioral Sciences, University of California at Los Angeles, to develop the initial videodisc hardware and its accompanying authoring software.

The initial goal of the project was to develop an interface card which would allow a personal computer to control all of the functions of a laser videodisc player. The computer, an Apple II series in this case, would be able to locate and show any of the 54,000 frames of information located on a videodisc. The computer would then superimpose language tasks over the visuals and the student would respond to the questions using a light pen.

One of the major concerns in designing the interface card was this ability to superimpose the questions directly over the visuals on the monitor. The designers felt that this was especially important when working with the hearing impaired. At that time, there were no affordable interface cards on the market which would accomplish this. There were, however, several which would allow the student to toggle back and forth from visual to question frames. It was felt that this process would not be acceptable for our needs. After several years of work, the interface card was developed along with a sophisticated authoring program. An authoring program is one which allows a teacher, with little or no experience with computer programming, to compose teaching tasks and lessons for the students.

A detailed description of the original videodisc project, hardware and software development, needs assessment, videodisc production, evaluation design and analysis can be found in an article written by Peterson and Brawley in the September 1983 issue of the American Annals of the Deaf. The remainder of this paper will deal with improvements which have been made in the hardware and software and show how this technology has been used to create a "state-of-the-art" interactive videodisc language lab serving both the students and staff of the school.

Goals

The project goals have remained the same since its inception. The primary goal is to "provide hearing impaired students with increased exposure to motivating language and reading experiences in an interactive visual medium, which employs computer technology to increase communication skills that more closely approximate the skills of these students' hearing counterparts."

"The secondary goals are to train teachers of hearing impaired students to use and adapt the project's language development software to better meet their educational goals and to provide adequate inservice training on the interactive videodisc system to show the staff the potential educational impact of this new technology."

Additional goals are "to improve students' skill and understanding of the language structures evaluated by the Test of Syntactical Abilities language evaluation: improve students' vocabulary skills: and to improve students' skills in sequencing events, recognizing correctness in grammar, recognizing correctness in syntax, question response, categorization, spelling, capitalization, punctuation and sentence construction."

Also goals have been established for the staff to "increase understanding of language structures evaluated by the Test of Syntactical Abilities, develop skills in using videodisc software to create tasks which complement the CSDR language arts curriculum, and interpret student videodisc lab performance and translate the information into meaningful classroom instruction follow up."

Hardware Requirements

The original interactive video system consisted of an Apple II Plus 48K microcomputer system interfaced to a Pioneer VP 1000 optical videodisc player. The computer would show the student a frame or series of visuals and then superimpose a language question over the picture. The student would then read the question and choose the correct response using a light pen.

During the past two years many technological improvements have been made in both the hardware and software. The current system consists of an Apple IIe microcomputer system with dual disk drives and a Pioneer LDV 4000 laserdisc player. An entirely new interface card and cords were developed for this setup. There were several reasons for these equipment changes. The Apple IIe computer is faster and has more memory that the II+ system. It also does not require the additional modification for upper and lower case letters that the II+ needed to function in the interactive system.

The Pioneer LDV 4000 is a much more compact and efficient videodisc player. It can access individual frames in a fraction of the time that the VP 1000 could.

The interface card was where most of the technological improvements were made. The original card, because it was somewhat developmental, contained a great deal of hand wiring and was found to be prone to mechanical breakdowns. The new interface card is more of a solid state design that we hope will prove to be more dependable.

The new model also allows much more accurate control of the videodisc player by the computer. It is much more exact at locating and showing individual or sequential frames from the videodisc. The prototype system was sometimes not accurate at stopping at the correct "ending frame". The new interface allows for exact location of all beginning and ending frames and any videodisc.

The most significant change in the updated hardware is the addition of a Corvus networking system. Up to this point all of the teacher made lessons have been stored on "floppy disks." Each lesson occupied a single disk. The student would "boot" up the disk and go through the program. The biggest complaint from the students during the field test program was that the system was too "slow." One reason for this was that the computer had to "access" the disk drive for each question on the lesson. Since the "access" time for a Corvus is almost instantaneous, the updated systems will be much faster. A Corvus can also store hundreds of disks of information. During the first year of the lab, about 200 units were authored. This presented a problem. Since each interactive system requires its own set of lessons, the disk management problem was becoming difficult. Eight systems with 200 units each would require 1600 floppy disks! Utilizing a Corvus system would alleviate the need for all of these disks, thus providing for a much more efficient system.

Responses to the questions can still be made using a light pen. The Gibson light pen has been incorporated into the modified system. We have found this pen to be more dependable than the one used with its predecessor. Another improvement is that the students are given the choice of using either the light pen or the keyboard to make their responses. This was not possible with the previous system. This allows us to be less dependent on the operation of the light pen and also lets students who do not have the fine motor coordination to operate a light pen apparatus use the system.

In addition, an "accelerator card" has been added to the computer to help further with the problem of "sluggishness."

Finally, each system is connected to either an Epson or Imagewriter II printer. Upon completion of every lesson, a printout of the student's average score and a percent score for each question attempted is given. This information is kept in the lab to be shared with the teacher.

Software

The real backbone of an interactive system is its software. The authoring software is that which gives the computer the ability to control the videodisc player and provides teachers with the framework to create lessons for their students. There are many authoring programs on the market today. These were studied and found to be very limited in their capabilities. Most allow only for simple true/false, multiple choice or fill in the blank types of questions. In order to make the system capable of teaching language efficiently, a much more sophisticated program was needed.

After years of work an authoring program has been developed which allows the teaching of language tasks using nine different types of questions. They consist of the following:

1. Forced Attention - The student is shown a visual and a "caption" or explanation appears on the screen. The student merely reads this and proceeds to the next step.

2. Sequencing - The student is shown three separate visuals and then must select which action came first, second, and third.
3. Grammar - The student is shown three sentences, one of which is grammatically correct. The student must select the correct sentence.
4. Completion - The student is shown a sentence with a word or phrase missing. The student must select the correct fragment from three which are given.
5. Syntax A - The student is shown three sentences, only one of which is syntactically correct. He must choose the correct one.

   Syntax B - The student is shown parts of three different sentences. He must choose one and then make a sentence with a correct completion.

   Syntax C - The student is given all of the words of the sentence he chose in part "B", but they are mixed up. He must put them in order to make a syntactically correct sentence.
6. Question - This is a simple multiple choice task. The student is given a word, question or sentence with three choices and must choose the correct one.
7. Categorization - The student is given two categories and eight selections to match. These can be words, phrases or sentences.
8. Spelling - The student is shown a sentence with one word missing. The student uses the keyboard to type in the correct spelling of that word.

9. Punctuation and Capitalization - The student is shown a sentence with no punctuation or capitalization. The computer goes to each word and asks if a capital letter is needed. It then goes to each "space" and asks if any punctuation is needed.

When the student works on a lesson, he sees a visual stimulus and then reads the questions on the screen. He makes his responses using either a light pen or the keyboard. If the response is correct, the program automatically proceeds to the next question or task. If the response is incorrect, the student either repeats the visual and question, or is "branched" into a series of "intervention" steps which will help him in making the correct choice. The branching gives the student an example of correct usage for the task and then repeats the question. Again the computer mixes up the responses each time the questions are presented. It is this branching and intervention phase that makes the interactive videodisc such an exciting technology. The student is not learning rotely but is guided through the program at his own speed and his progress is dependent upon his responses to the questions. If the student understands the material, he proceeds quickly to the end. If he has trouble, the special branching steps have been included to remediate the problems.

At the completion of the lesson, the student is given a printout of his performance. This printout gives a total percentage of correct responses, as well as listing which questions were completed and how many attempts were made to complete each one.

Not only is this program versatile, it is also fairly simple to use. A teacher with only minimal inservicing can sit down and create meaningful lessons in a relatively short time. The "lesson" consists of a series of questions. The authoring program is menu driven and the teacher merely decides the number and types of questions that will be used. The lesson may be as long or short as necessary. The questions can be any combination of the nine types previously described.

First, the type of task is chosen. The computer then asks for the question or sentence and the correct and incorrect responses. Next, the frame number of the visual is typed in. (Since the disc can have as many as 54,000 frames to choose from, this is often the most difficult part of authoring!) The visual can either be a still frame picture or an action segment. If it is an action segment, the computer needs to know the beginning and ending frame numbers. When all of the questions have been saved on the disk the author can "review" the tasks: "renumber" the questions: "delete" and change any questions which are not satisfactory. When finished, a printout is made for a hard copy and the lesson has been saved on a floppy disk.

Since the author is free to use any questions and compose those questions in whatever way desired, you can see the versatility of this program. A simple vocabulary matching lesson can be prepared for young or lower functioning students: or complex grammatical tasks can be prepared for older or more advanced ones. The possibilities are seemingly endless.

The Lab

The lab consists of eleven interactive systems. The eight updated units are connected to the Corvus and are being used for language and reading instruction. The three prototype systems are "stand alone" and will be used in the future with a commercial authoring system for the teaching of science concepts.

During the last year, approximately 200 language lessons were created using the authoring program. These units were all based on the Test of Syntactic Abilities (TSA). This test was developed by Stephen Quigley to diagnose which aspects of English language structure have been mastered by hearing impaired students. The TSA consists of a screening test and sub-tests which assess the following structures: negation, conjunction, complementation, relativization, question formation, verb processes, pronominalization, determiners, and nominalization.

The screening test is available in both paper and computer software formats and is administered to each student before enrollment into the lab. The results of this test are recorded in the student's file so both the lab and classroom teachers can select appropriate units for lab work.

The language units have been placed onto the Corvus and are broken down even further into the following categories: negation, conjunction, disjunction, alternation, determiners, question formation, answer environments, "wh" questions, yes/no questions, verb processes, verb sequence in conjoined structures, main verbs, linking verbs and auxiliaries, the passive voice, pronominalization, forward and backward pronominalization, reflexives, possessive pronouns, relativization (comprehension), relative pronouns, relative adverbs, embedding, complementation, infinitives, gerunds, "that" complements and nominalization. There is also a "miscellaneous" category for units which do not fall into any of the previous mentioned areas.

As you can see, the teacher has a great deal of material from which to choose. If lessons are needed which have not been previously developed, one of two things can be done. The teacher can come into the lab and prepare his or her own units. We are hoping for that at least 25% of our staff will be willing to prepare their own lessons. Detailed inservices will be provided throughout the year for this purpose. Secondly, a teacher can request that the lab teacher prepare a special unit for their class. Special forms have been created for this purpose and require a week's notice from the teacher. Special units have been prepared for both lower and higher functioning classes. These units include things like: simple vocabulary identification, pronoun usage, adjective identification and phrases, etc. Each unit prepared is also attached to a corresponding level in the Reading Milestones series. As each unit is created, a criterion referenced test is prepared. These serve as "pre" and "post" tests to be completed by the students as they progress through the language program.

The teacher is also given much flexibility in scheduling. They are able to send students either singly (for remedial work) or as an entire class. Since the lab lends itself easily to individualization, each student can be working on a specialized lesson chosen according to his TSA test results, or they can all be working on the same lesson chosen by the teacher to correspond with work they are doing in the classroom. Frequent conferences are held between the lab and classroom teachers to decide the content of the students' lab work. This also provides for maximum teacher follow up in the classroom.

Up to now, not much has been said about what videodiscs are used in connection with the software. The initial project produced two 27 minute videodiscs. These are titled, "Discoveries With Dusty Parts I and II". The contents of these discs were the experiences of an old miner named Dusty and his friend, Rocky. They perform using sign language and visit various places around the city. They visited places and performed activities that a typical person might come into contact with during his daily life. The pre-production scripting was done to give a maximum of visuals that would lend themselves for the teaching of the language concepts from the TSA. Since the discs contain only visuals and no built in questions, a great deal of flexibility is maintained. These same discs can be used for any level of student, since the degree of difficulty is determined by the accompanying software and not the disc itself.

The majority of lessons to date have been prepared using the two "Dusty" videodiscs. Units are now being prepared which "re-purpose" other videodisc materials. Re-purposing means using other discs for their visuals and adapting them to suit your lessons. Since the computer doesn't care what videodisc it is using, we are now using discs such as "The Adventures of Donald Duck" to teach prepositions and color and pronoun identification. Imagine how motivated a student would be to learn about verb tense using visuals from "Star Wars" or "Raiders of the Lost Ark!"

The lab built up an extensive library of videodiscs in the following areas: science and space, literature, entertainment, math, history and others. We have even used a disc from a popular arcade game, "Dragon Lair".

As with any lab, a great deal of time is spent keeping the lines of communication open. Numerous inservices are given to the staff as well as outside agencies. Topics for these inservices are: the hardware, the software, the TSA, the units available, authoring for interactivity, re-purposing the videodiscs, and following up the classroom.

Detailed records are kept of the students' progress and reports are prepared for the teachers and parents for each term of the school year. Record keeping time is kept to a minimum by using a commercially available filing program. We have found that the "PFS" series accommodates our needs quite will and is fairly easy to use.

A monthly newsletter is prepared by the lab teacher to keep the staff up to date on all the improvements and additions of both hardware and software. An open house is held annually to increase staff awareness and involvement. The videodisc lab, like any computer lab, can often be a very threatening place for teachers who are unfamiliar with technology. This feeling has been kept to a minimum by maintaining an informal and open atmosphere in the lab. The teachers are free to visit as often as desired. They are also free to be involved as much as they feel comfortable. They are able to attend whatever inservice they desire and can progress at their own speed.

The response to the lab has been extremely positive by both the staff and the students. During the first year, the lab was available to only the Elementary, Junior High School and Deaf Multi-Handicapped Units. We received 100% involvement form the Elementary School, 80% from the Junior High School, and about 20% from the DMHU. At the end of each year a lab evaluation questionnaire is completed by the staff members who make use of the facility. One hundred percent of the teachers stated that their students had shown a noticeable improvement with their language structures and that they planned to continue using the lab with their future classes. With the larger number of machines available, the lab can now serve an even larger population. We have increased the number of DMHU students to about 50% and are in the process of opening the lab to High School language and reading classes.

In the past students were only able to attend lab once a week. The larger capacity allows classes to increase to two or more times a week now. The student response to the lab has been very encouraging, after all it is the who is the integral part of the system. It is their "interaction" with the system that creates an exciting and motivating and motivating learning tool out of what would otherwise just be a collection of expensive machinery. Most people think of interactive videodisc as the union of a computer and a videodisc player, forgetting that the third and most important ingredient is the student.

The enthusiasm which can be observed in virtually every student participating in the lab is difficult to measure, but gives validation to the entire project. A great deal of time, effort and money has been invested by numerous people. What was once just an idea was converted to a full scale research project, then a field test project, and now a reality which benefits a large number of children. We are comfortable with our feeling of pride in what we have accomplished. We have come a long way, but the work is not over by any means. Continued efforts will be needed to keep this program growing and expanding to meet the ever changing technologies and changing needs of our population.

The SonomaVoice: An Inexpensive VOCA

Bob Russell
Sonoma Developmental Center
Eldridge, California

Speech synthesis has great potential for enhancing the communication of people who cannot speak clearly enough to be understood by others. The SonomaVoice is an inexpensive VOCA (voice output communication aid) designed and produced on an at-cost basis at Sonoma Developmental center by the California Department of Developmental Services.

People who cannot speak or who cannot speak clearly enough to be readily understood by others, have, over the years, used a variety of communication systems. These range from informal gestures to signing, eye transfer, written, pictographic, and other visual symbolic systems. Communication boards and communication books have become common. In recent years, advances in electronic technologies have led to the development of very sophisticated visual communication aids as well as making possible voice output communication aids. Voice output has particular advantages for many users of communication aids. It provides immediate feedback regarding the correctness of a selection; this may promote very rapid learning. For most people, this ease of learning is a strong motivational factor. Another advantage of voice output is its ability to span distances; the user is not dependent on the recipient's being in a position to see the graphics of a visual system. Further, voice output systems do not require that the listener understand any particular symbol system which may be employed by the user. In addition, the use of a voice output device often enhances both the self-perception and the perceived status of the user.

When the cost of speech synthesis dropped significantly early in this decade, an interdisciplinary group at Sonoma Development Center drew up a list of criteria for speech synthesizing communication aids appropriate for use by their client population. The following characteristics were considered essential:

- Portable
- Fast and easy to use
- Individualized:
  - Means of operation
  - Physical structure
  - Vocabulary
- Rugged
- Reliable
- Repair and/or modify quickly, simply, and inexpensively
- Inexpensive.

To be truly effective in someone's life, a communication aid needs to go with the person where he/she goes. If it is only available in a therapist's office or the classroom it may be useful for learning, but it will have less impact on her/his daily life. Operation from batteries, minimal weight, and compactness are important factors in portability.

What is fast and easy to use for one person may be useless for another. The choice of direct selection or indirect (scanning), type of scanning if used, absence or presence and amount of keyboard acceptance delay (debouncing), type of switch(es) or keyboard and their placement, all must be tailored as much as feasible to the individual user.

A custom vocabulary is an important aspect of suiting a communication device to an individual's needs. Ideally, the device itself my be used to create, alter, and store its vocabulary. If the device lacks this feature, then custom vocabulary programming in some form must be available. There is no fixed vocabulary which will adequately meet the needs of all users!

Ruggedness and reliability are crucial features of adaptive equipment, particularly of electronic devices. Equipment which is too fragile to be used freely has limited usefulness. Equipment which breaks down often will cause substantial frustration for the user, to say nothing of expense. When you need an electronic communication aid, you need to be able to use it when and where you wish and to be able to rely on its performance.

Sooner or later something will need to be fixed or changed. Unfortunately, sending a device to the manufacturer for repair and/or modification, waiting for the work to be done, and waiting for the device to be shipped back, can take a long time. Ideally, simple modifications and repairs can be accomplished locally without sending the device off to the factory. While things can't always be this simple, it is clearly an aspect which must be considered in the selection (and design) process.

The cost of a communication aid is undeniably very important, but it is not the primary factor. The first consideration has to be that the device is appropriate for the user. Communication aids may be paid for by the user of the user's family, by insurance, by some agencies such as California Children's Services, by the Regional Centers, etc. Schools may purchase communication aids for educational purposes. While these do not become the property of individual students, they do offer an excellent opportunity for students to accomplish and demonstrate skilled use of a device. This may make it significantly easier to get funding for an individual's own communication aid. Some local social organizations may also be interested in paying for an occasional device, particularly where skilled use has been demonstrated.

The SonomaVoice was designed with the foregoing criteria in mind, especially low cost and simplicity of use. In this instance, simplicity of use consisted of big easily pressed keys which could produce an entire message and the capacity to use large user-supplied and easily changed graphics to represent the messages.

The voice in the SonomaVoice is electronically generated using a phoneme synthesis microchip (Votrax SC-01A or equivalent). This technology employs format synthesis, an electronic modeling of the human speech mechanism, to generate individual phonemes. It can produce all of the phonemes of English and all those of Spanish with the exception of the rolled 'r'. Each phoneme has been assigned a numeric code by the manufacturer. Transmission of an appropriate sequence of numbers to the speech chip results in output of the corresponding sequence of phonemes. This makes practical the development and programming of individually customized vocabularies using an appropriate computer and software. The Communication Engineering Department at Sonoma Development Center programs custom vocabularies for the SonomaVoice in both English and Spanish.

While this type of speech synthesis can provide fairly good quality speech, it does have certain deficiencies. Because of this, the Communication Engineering Department carefully programs each new phrase in an effort to compensate for weaknesses in the technology and to enhance comprehension and naturalness of pacing. Some phrases are fairly easy to program satisfactorily, while others are much more difficult. The average time required for programming is about four minutes per phrase.

When a new phrase has been satisfactorily programmed it is given a code number and added to a phrase data base. Listings of this data base are available on request. They can give people good ideas about what phrases other people have used on SonomaVoices, and judicious use of phrases already in the data base can save money.

This may suggest a cost-efficient approach to selecting phrases for an user's device. It is most important to keep in mind that it is the ability to customize the vocabulary for the particular needs of each user which makes the SonomaVoice so effective. This individualization is usually compatible with selecting a substantial number of phrases from the phrase list.

The maximum length of a phrase in the sonomaVoice is 61 phonemes. A phoneme is a single unit of sound. In the case of "m" or "t" for example, there may be a one-to-one correspondence between letters and phonemes. In many instances, however, it is more complex. For example, "I", "ow", and "a" may be three, four, or even five phonemes long.

Contex is very important in all speech comprehension. This is particularly true in the presence of significant background noise or when there are deficiencies in the speech itself. Single-syllable and some one-word utterances can be particularly difficult to understand. Multiple-syllable and/or multiple-word phrases are generally more readily understood. This should be considered when developing vocabularies for speech synthesizing communication aids.

A computer stores the phoneme codes for the vocabulary in a single EPROM memory chip. When the user wishes to change the vocabulary, a revised memory chip may be ordered from Communication Engineering. The SonomaVoice cannot be used to alter its own vocabulary.

Because of the limitations of the presently available speech synthesizing technologies, the voice in the SonomaVoice is the 'male' range. The pitch may be adjusted within this range by an internal control. When several SonomaVoices are to be used in the same area, adjusting the voices to slightly different pitches allows listeners to learn to recognize which user is speaking.

SonomaVoices may be ordered with a capacity of either 64 or 256 phrases. Ones with a capacity of 64 phrases may later be easily modified to accommodate 256 phrases.

In the standard configuration, the SonomaVoice has 16 phrase keys and 4 level selection keys. Each level contains a set of 16 phrases, one for each phrase key.

Developed for use in the SonomaVoice is a large diameter (1 1/2") highly reliable, waterproof key switch which requires minimal activation pressure and travel. The easily removed and replaced keyguard defines the key spaces and provides the means for mounting the user-supplied graphics. The standard keyguard on a 64 phrase SonomaVoice has 20 openings. These accommodate the 16 phrase keys and the 4 level selection keys. For a 256 phrase capacity, another key, the shift key, is added. This allows the user to select from among 16 levels by first briefly pressing the shift key and then pressing one of the 16 phrase keys.

Keyguards are also available which have fewer than the standard number of key openings. The most common use of this is to restrict access to level selection. When this is done, the device itself still has full level selection, but the keyguard blocks access to the level selection keys. Under these circumstances, those people who assist the user do the level selecting to suit changing situations.

Schools can take advantage of this option by programming a separate level for each of up to 16 students. Alternatively, they may program three levels with a general-use vocabulary and up to 13 levels with individual vocabularies. A student may then learn level selection and the phrases on the three general levels as well as the phrases on his own individual level. The transition from this arrangement to mastery of his own SonomaVoice is relatively simple.

Keyguards are available in other forms as well. For some people it may be best to start with just two or four phrases on widely spaced keys. Keyguards with 2, 4, 6, and 8 key openings with 'optimal' spacing are available as standard items. Other combinations are available on request. Preliminary experiments have indicated that use of a keyguard with phrase key openings expanded to encompass four keys are useful for some people. The four phrase keys are all programmed to say the same phrase. One must be aware, however, that there are inactive spaces between keys on the SonomaVoice keyboard. This expanded key opening arrangement will only work reliably when the user's contact with the keyboard (full fist or open hand, for example) is broad enough to insure that one or more keys are pressed.

The SonomaVoice may be operated for an entire day from its fast-charge NiCad batteries, replacements for which must be obtained only from Communication Engineering. The supplied charger will recharge the batteries in about four hours. The charger is UL approved for this application, and no other charger may be substituted. The SonomaVoice may be operated from the charger (although a hum will be apparent when it speaks) with unduly increasing charging time.

SONOMAVOICE intended for individual use should be charged nightly 'whether they need it or not'. Under these circumstances, the batteries will last about 12 to 18 months. It is true that if the batteries were never recharged until fully discharged, they might last up to 30 months. But it is more important that an individual's communication aid be always available for use.

For some individuals, a very useful SonomaVoice option is the keyboard acceptance delay (debouncing) circuit. Its effect is that the user must press a key for a predetermined period before the SonomaVoice accepts the selection as valid. This is helpful for people who may briefly press keys accidentally on the way to their intended selection. This option is also available with a switch so that people whose motor control varies may select either to two delay amounts. Many teaching and evaluation sites have acquired evaluator models of the SonomaVoice which have switchable keyboard acceptance delays of zero, one-half, one, and one-and-one-half seconds.

A variety of options and modifications are available on request; inquiries are encouraged. The Communication Engineering department at Sonoma Development Center deals directly with individual users and their representatives. SonomaVoices are custom manufactured and distributed on an at-cost basis by the California Department of Developmental Services at Sonoma Development Center. Prices reflect the cost of materials, the labor, and the overhead associated with this project. The two major variables in price are options and vocabulary programming time. The latter may be optimized by consulting a current phrase list when developing a user's vocabulary. A typical SonomaVoice cost, at this time, about $400.

While the SonomaVoice was originally developed to meet the needs of developmentally handicapped individuals, it is also used by a wide range of other people with communication needs. I is presently used by people ranging in age from 3 to 80 years with conditions ranging from cerebral palsy to post-stroke expressive aphasia. Indeed, it has been suggested that its simplicity make the SonomaVoice particularly appropriate for very early use by physically challenged youngsters who are not yet able to operate the more complex devices they will one day employ.

The Importance Of Keyboarding Skills In Computer Usage With The Handicapped

Thomas Saka
University of Hawaii at Manoa
Honolulu, Hawaii

Abstract

Today computers have become tools which influence innumerable aspects of life. Studies have shown how the computer is an excellent means of closing the learning gap between regular and special education students. While much talk concerns the valuable role that the computer can play as an instructional tool, the consensus seems to be that keyboarding skills are not given the time and attention they deserve. Five developmentally disabled individuals were able to achieve high levels of success using the computer as a work tool. The success is partly due to the keyboarding skills they possessed which allowed them to maximize the power of the computer.

Introduction

Studies (Goldstein, 1964; Heber and Dever, 1970) have pointed out that special education students are those who have the poorest acquisition of skills and who meet with tenuous occupational and social success as adults. It is often the case that when new technologies arise, handicapped individuals are often the last ones to be exposed to the innovation. This has somewhat been shown to be the case with computers. Given the evidence that in the future computers are likely to become tools for extending human intellect, influencing innumerable aspects of life, it is particularly important that these subjects are taught to use this tool to the best of their ability (Christensen and Cosden, 1986).

Studies of the use of computers in learning found that computer-assisted instruction was shown to be more effective for students of low ability than those with average or high ability (Kulik, Kulik, and Cohen, 1980); Halpern, 1984). Previous studies (Reith, Polsgrove, & Eckert, 1984; Rosengrant, 1985) explain how the computer bridges the learning gap for students with handicaps; immediate feedback, constant attention, personalization and positive reinforcement provided by the computer create an ideal learning environment for persons with handicaps.

The computer can be a powerful machine which accomplishes tasks and extends a person's ability to work and learn. On the other hand the computer can become a very complex machine which seems impersonal and impossible to communicate with. Wetzel (1985), Stewart & Buford, (1983) Kisner, (1984) and others identified a lack of keyboarding skills as the heart of the problem related to an inability to effectively use the computer. Before people can do more writing, learning, or word processing which puts the computer's power to work for the operator, the common stumbling block of a lack of typing skills must be overcome (Craig & Switzer, 1983). Many research studies talk about the valuable role that computers can play as instructional tools but the concensus seems to be that keyboarding skills are not stressed enough. Without adequate keyboarding skills subjects waste valuable time searching for the right keys. With developmentally disabled individuals speed is an even greater concern and efficiency is of grave importance.

The "hunt and peck" form of typing is not suitable for applications which require long responses (Kisner, 1984). More importantly the ability to use a keyboard effectively gives the operator the feeling that he or she is in control of the machine, thus, increasing their self confidence in using the computer. Research in the area of perceived self concept and control (Purkey & Novak, 1984; Coombs, Avila, & Purkey, 1978); and Coopersmith, 1967) conclude that self confidence is correlated with success. Perceived self confidence is the basic motive behind all human behavior and those high in their own self esteem approach tasks with the expectation that they will be well-received and successful. Success with prior experiences also develops motivation which is a key psychological element in the learning process (Witrock, 1979). Bandura (1977) states that the opinion of how one can perform a task directly affects how that person performs that task.

Keyboarding skills appears to be the basis for successful interaction with computers. The potential of the computer is great for increasing the learning and work possibilities of handicapped individuals. The ability to independently manipulate the computer will more than likely raise the developmentally disabled individual's faith in the ability to succeed. These reasons warrant that more time and effort be put into helping handicapped individuals obtain adequate keyboarding skills. The following is the description of a study which concentrated on teaching keyboarding as the basis from which other computer skills could be developed.

Method

The five subjects who took part in the study were certified as being developmentally disabled following the criteria set by the Hawaii Planning Council on Developmental Disabilities. They were three males and two females who ranged in age from twenty to thirty four. The primary disabilities of the subjects were mild mental retardation, Cerebral Palsy, Infantile Autism, and in one case a combination of disabilities. All of the subjects were at about the prevocational work activity level and would have been placed in sheltered workshops had they not taken part in this study. None of the subjects had any previous computer or typing skills.

The training took place over a six month period with sessions being held for two hours, five days a week. Since the objective of the larger study was to employ the subjects in computer-related occupations, the training conditions simulated an actual office environment. A corner of an engineering firm's office was leased and contained five personal computers and a printer. One wall was covered with a large layout of the keyboard which had color coded keys. On the same wall was another poster which displayed two hands and colored dots on each finger. The subjects were told that the colors on the fingers could only press the same colored keys on the keyboard. The "correct" usage of the keyboard was deemed essential to long term success in using the computer as a work tool and was stressed throughout the training period. The basic premise was to have the subjects obtain adequate use of the keyboard so that transfer of information from the mind to the computer would be efficient. The transfer of information was deemed important so that as the subject developed an idea or solution to the problem, the idea would not be lost due to an inability to enter the information quickly and accurately.

The keyboarding skills part of the training initially took six weeks to accomplish; however, subsequent studies have completed it in a shorter period of time. Due to the experimental nature of the study, extra time was alloted during this phase of training to insure that the subjects acquired the appropriate skills in an attempt to prevent keyboard-related problems later in the study.

The subjects were taught parts of the computer and proper handling of equipment during the first week of the study. The initial fear of computers was also eliminated through the use of games and simple graphics display programs which required pressing only the return key.

The typing drills consisted of ten individual typing exercises which were broken down according to the different parts of the keyboard. Each row of keys were introduced in two drills, one which had students pressing individual and groups of letters and the second was a more complex drill which contained actual words and short sentences. The subject was to type in exactly what appeared on the screen directly below each letter. The correct letter must have been entered before moving on to the next. A short musical segment and the time it took to complete the exercise was displayed at the end of the exercise.

The different typing drills were introduced at one week intervals. The order of introduction to the keyboard parts was determined by chronological use in introductory typing books. Accuracy was stressed throughout with speed being stressed only after adequate use of the entire keyboard was obtained.

The time of completion for each drill was automatically written to each student's disk and evaluated weekly. The typing test was introduced during the fourth week of training. The test evaluated students on speed and accuracy of their typing skills. In each of the tests, a paragraph or paragraphs appeared on the screen and the student was to type in the paragraph exactly as it appeared. Upon completion of the test, the number of words in the test, the length of time of completion, the number of words per minute and the accuracy were reported. A typing analysis which listed each letter that was pressed, the number of times it was appropriately pressed, the number of times it was pressed in error and the average strike time was written to the disk.

Through typing skills, the subjects were taught basic computer operations such as taking disk directories, loading programs and executing the programs. Direction sheets breaking down procedures (formatting disks, starting the computer, etc.) into minute steps were developed to allow the subjects to work independently of the trainers. Repetitious learning was the model used due to its probability of success with the population of subjects involved. The typing drills and tests were used over the six month training period in hopes that repetition would increase correct keyboard usage.

Results

The data, collected daily from each of the subjects relative to typing (words per minute and accuracy) were collected for each individual subject first, then the group as a whole. The scores were grouped in one month intervals from which means and standard deviations for each measure were calculated. The means are presented in Table 1.

Table 1

Summary Statistics of Typing Speed and Accuracy

Month	Words Per Minute Mean	Words Per Minute S.D.	Accuracy Mean	Accuracy S.D.
1	10.17	1.82	74%	10%
2	11.16	1.96	81%	10%
3	15.30	1.07	75%	11%
4	17.52	1.44	84%	6%
5	19.10	1.82	86%	8%
6	22.93	2.61	88%	5%

The mean typing speed of subjects increased consistently throughout the six month training period. The biggest increase in typing speed occurred between the second and third months.

The mean typing accuracy was relatively consistent throughout the first three months of the training. The first and third months which had the lowest mean accuracy had high standard deviations. The last three months showed a slight increase in accuracy.

Discussion

The success that the subjects attained in achieving word processing and data entry skills which were taught later in the study can be attributed to the sound keyboarding skills that the subjects possessed. In order to attain maximal use of the power of the computer, time cannot be wasted trying to enter information or commands into the computer.

As computer-related problems arose, steps towards correcting the problem were taught in specific steps. In the early stages of the study, the subjects were able to cognitively obtain a solution but became frustrated by their inability to get the computer to do what they had intended. Once familiarity with the hardware was achieved, software related problems were more efficiently resolved.

Although data was not collected on education achievement, comments from the parents of the subjects and the trainers' observations concluded that the subjects ability to acquire new information increased at noticeable rates. The largest gain in typing speed occurred just after the subjects had attained the skills necessary to use the entire keyboard. At this point in time, the subjects also began to display greater levels of self confidence towards using the computer which carried over to their learning ability. It appears that the mastery of keyboard skills by persons with developmental disabilities is the basis for successful computer usage.

References

Bandura, A. (1977). Social learning theory. Englewood Cliffs, N.J.: Harper & Row.

Christensen, C. & Cosden, M. (1986). The relationship between special education placement and instruction in computer literacy skills. Journal of Educational Computer Research, 2, 299-306.

Coombs, A. W., Avila, D., & Purkey, W. W. (1978). Helping relationships: Basic concepts for the helping professionals. Boston: Allyn and Bacon.

Coopersmith, S. (1967). The antecedents of self-esteem. San Francisco: W. H. Freeman.

Craighead, D., & Switzer, M. E. (1983). Is typing the key to computer literacy? Instructor, 93, 178-180.

Goldstein, H. (1964). Social and occupational adjustment in mental retardation: A review of research. Chicago: University of Chicago Press.

Halpern, N. (1984). Artificial intelligence and the education of the learning disabled. Learning Disability, 17, 118-120.

Heber, R. F., & Dever, R. B. (1970). Research on education and habilitation of the mentally retarded. In H. C. Haywood (Ed.), Social-cultural aspects of mental retardation. New York: Appleton Century Crofts.

Kisner, E. (1984). Keyboarding - A must in tomorrow's world. The Computing Teacher, 11, 21-22.

Kulick, J. A., Kulik, C. C., & Cohen, P. A. (1980). Effectiveness of a computer based college teaching: A meta-analysis of findings. Review of Educational Research, 50, 525-544.

Purkey, W. W., & Novak, J. M. (1984). Inviting School Success. Belmont: Wadsworth Publishing.

Reith, H. J., Polsgrove, L., & Eckert, R. (1984). A computer-based spelling program. Academic Therapy, 20, 59-65.

Rosengrant, T. (1985). Using the computer as a tool for learning to read and write. Learning Disability, 18, 113-115.

Stewart, J., & Jones, B. (1983). Keyboarding instruction: Elementary school options. Business Education Forum, 37, 11-12.

Witrock, M. C. (1979). The cognitive movement in instruction. Educational Researcher, 8, 5-11.

Adapting Microcomputers For Special Needs Adults At Pearson Hospital

Edward Summers, Jean McIntyre, Alain Brunel, Joan Clarkson
Pearson Hospital and University of British Columbia
Vancouver, Canada

Abstract

While much is being done in utilizing technology in special education/rehabilitation, the need still exists to provide better information on potential microcomputer applications for disabled individuals. This paper describes an information transfer project conducted at Pearson Hospital in Vancouver, British Columbia in which two hours of 1/2 inch video tape were produced which can be used in delivering information to a variety of audiences on possible microcomputer applications were severly physically disabled adults. The video production process is detailed in the paper and the contents of the final video tapes are described including the specific hardware and software used by disabled adults in accessing microcomputers for self development, education, communication, and recreation.

Introduction

It is being increasingly demonstrated that technology can provide opportunities and add options for the disabled in many areas of life. Through technology, physically disabled individuals can control and interact with their environment more autonomously thereby increasing their personal development, independence and dignity. Computers can be used in developing skills ranging from assisted communication, writing independently, using switches and sip and puff morse code input to pursue educational interests. or communicating on a broader scale via modems and computer networks. Although many technological applications are available, a major problem exists in the transfer of existing technology to the disabled.

Unfortunately, in spite of widespread public use, computers are still viewed by many audiences as a luxury rather than a necessary, cost-effective extension of the therapeutic/rehabilitative process. However, in many programs computers and therapeutic/rehabilitative activities are becoming natural partners in caregiving environments. Using microcomputers enhances concentration and motivation; users acquire new skills and gain peer group status as computing becomes a more acceptable activity; concept memory, reaction time, educational level, perception, and work traits can all be assessed by microcomputer; reinforcement for on-task behavior is consistent; users can work at their own pace, often independently without caregiver supervision; productive interactive environments can be established; and equipment can be scheduled in cost-effective configurations. Interestingly enough, the more microcomputers are used, the more economical they become.

Improving technology transfer often becomes a matter of providing information to various groups to illustrate the range of applications possible with computers. However, the process of providing timely and useful information is often too lengthy, complex, and encumbered with seemingly endless hurdles. Service providers and caregivers, working in the computer and information age, need to utilize efficient information transfer strategies in providing orientation, publicity, training and decision making in servicing disabled populations. The goal of the project described here was to produce a set of 1/2 inch video tapes which could be used to illustrate microcomputer applications with the various groups working with severely physically disabled adults in a residential hospital.

Background

Pearson Hospital, located in Vancouver, British Columbia, Canada, is a long term care facility operated by the Western Rehabilitation Society and is funded in part by the provincial government. Pearson has been pioneering in the use of microcomputer technology since 1980 and provides enriched programs in a total care and outpatient setting for disabled individuals. Residents of Pearson can be generally described as severely physically disabled young adults and adults, many requiring power mobility equipment and augmentative communication devices. A portion are respiratory dependent and many are dependent for self care activities. The range of disabilities includes multiple sclerosis, cerebral palsey, high level quadriplegia, traumatic brain injury, and deteriorating neurological conditions.

Residents of the hospital are encouraged to take part in physical, social and intellectual activities designed to assist them in leading lives that are as normal as possible. An earlier report by Stride (1982) detailed some of the initial microcomputer activities of the hospital designed to enrich the lives of the residents and provide vocational application where possible. These included adaptations for computer access, using the computer as a typewriter, computer programming, word processing and voice synthesis, recreational use, and other activities related to computer awareness and computer literacy.

Development of the Video Project

The availability of new aids and the development of models for the delivery of technologically aided educational, therapeutic and rehabilitative services has created the need to inform a variety of audiences to help them understand possible adaptations and uses of computer technology for special needs adult populations. This need became more evident in Pearson hospital because, since 1982, microcomputer applications have continued to build on the earlier innovative foundation described by Stride.

Microcomputers are increasingly being used to provide motivating, engaging and stimulating activities in many areas for residents of the hospital on the wards, in Pearson School, and in outpatient activities and training programs. A variety of professionals - including educators, occupational therapists and administrators - and technicians, volunteers and student aids and interns interact and collaborate in the Pearson programs using microcomputers. At varying levels, all have need for background information, inservice training, orientation and general consciousness raising with respect to the extent of computer activity and the potential for future development in this area. In addition, the resident groups need information on what is happening with computers on a hospital-wide basis. Finally, many agencies and support groups outside the hospital could also benefit from information which can be used to provide orientation and promotional activities related to the mission of the hospital. A fortuitous set of circumstances brought together hospital staff and faculty and students from the Department of Educational Psychology and Special Education of the University of British Columbia and enabled us to acquire equipment, develop a production model, and collaborate in the making of a set of informative video tapes designed to provide a visual sample of the range of ongoing microcomputer applications in the hospital.

The use of audiovisual media has a long history in the transfer of information for various purposes. Bunch (1983) noted that high technology training and communication media are rapidly gaining acceptance in business and industry and, in a broad survey reported in 1984, Hope found a dramatic increase in audiovisual media and media uses in many areas of business and industry. Long (1984) suggested that in Canada, expenditures for media training are proportionally higher than in the United States. Broadcast television programming is now widely accepted and non broadcast linear video is also gaining acceptance. In Canada, it has been found that more money is now being spent on non broadcast video programs than is spent on broadcast television programming (International Television Association, 1985). The development of the video camera in particular has provided an economical and easy to use technology for the transfer of information.

Medical applications of video technology include staff, counselor and volunteer training for both physical and psychological health care (Heilveil, 1983; Von Son, 1982). Although not as widely documented, video technology is also being increasingly used in the special education/rehabilitation field for information transfer and training (see for example, the listing of video film resources appearing in two recent conference proceedings volumes of the Rehabilitation Engineering Society of North America (Brubaker, 1985; Donrath, Friedman and Carlson, 1986). There are numerous advantages in using video including: (1) equipment is now readily available and transparent to use, (2) the medium is cost-effective in comparison with other information transfer technology, (3) video can provide for consistency in the presentation of information yet it offers flexibility in viewing schedules, and (4) video has a great deal of visual impact ad can quickly capture audience attention.

Production of the Video

A model of the video production process includes five major stages (1) design, (2) production, (3) evaluation, (4) utilization, and (5) distribution.

In the DESIGN stage, the decision to develop a video production arose from the need to provide more information on microcomputer applications for various audiences related to Pearson hospital. The goal was established to develop an information rather than a training video per se; target audiences within and outside the hospital were defined; and the long and short term objectives necessary in producing a series of video segments describing microcomputer activities throughout the hospital and its special programs were identified. Half inch video was selected as the most feasible and economical medium with approximately two hours of finished video planned. An expository/discussion type format was chosen for the video resulting in an informal rather than a strict scripting approach to content; resources included contributed time, loaned equipment and purchased tape. The production schedule was set up to cover a five day period with a one day pilot shooting of some inservice activities planned to try out equipment and work through technical and production details. The pilot project proved to be a crucial preliminary activity in producing the video. Plans were made to show the completed video to a large and varied audience to obtain informal feedback and evaluation. It is important to include special needs adults in making decisions about all activities which involve their time. In addition, because of the planned use of the video as an information tool, it was also necessary to have those residents involved in the filming give formal consent for use of the video in later training and promotional activities. A large meeting was held early in the project to explain the need for the video, its intended uses, and provide details of how the residents would be involved in production. The residents showed great interest in the project and endorsed it with considerable enthusiasm. After discussion and questions, formal consent forms were signed. This initial information session proved to be one of the most crucial phases in planning the project. A supportive climate was created which influenced all aspects of the later production of the video.

The PRODUCTION stage involved the logistics of scheduling, selecting sites for scenes, moving equipment, planning for filming, and setting up shots involving staff and residents. Because of economics and the informational purpose of the video, detailed storyboarding, scripting and rehearsing were not done. Discussions were held with participants outlining what was generally wanted in the various shots and then the filming was done. We basically asked participants to "do their thing" and let us film it. Although this resulted in some additional footage and increased editing time, it also provided a finished product which has a personal, direct and informal quality. Considerable editing, involving numerous consultations, was necessary to shape the raw footage into a finished video. Titles and credits were organized and technical details worked out. Additional graphics, voice-over and bridging shots were added during editing and unnecessary footage was cut. Technical and formative evaluation was done by university faculty members. Scheduling is a crucial factor in developing a video working with a resident disabled population with just a few days allocated for shooting. Many residents required two or more hours of preparation to participate in a one or two minute segment of the video. The shooting schedule required careful coordination with the other ongoing activities of the hospital - in fact, we totally disrupted the normal schedule of the hospital for a full week! Again, the early planning an commitment of residents and staff to the project paid off later in scheduling and shooting activities.

A summative viewing of the finished video by all resident participants, staff, volunteers and other interested individuals was organized to obtain informal EVALUATION and begin the UTILIZATION stage for the video. The event was publicized and the video presented in a semi-formal setting in the activity room of the hospital using as large screen. The evaluation at this stage was informal and continued evaluation will take place as the video is used in activities in and outside the hospital.

No formal plans were made for DISTRIBUTION or marketing of the video. It is available for use by hospital staff, for use by faulty members in special education courses at the University of British Columbia, and by other interested parties on request to the hospital.

It is important to note that at various points during production, the loop between the above stages can be recycled depending on events and necessary changes during filming, editing etc. For example, if unforseen difficulties arise in the production stage, some of the earlier objectives formulated in the design stage may be modified or scrapped entirely. In editing, additional bridging materials, graphics or retakes may be needed necessitating changes in previously planned content and organization.

Content of the Video

The two hour video is divided into four major sections with 11 related sub-sections. Two additional sections provide an indepth look at the assessment process and the use of the Adaptive Firmware Card.

Introduction. This section includes introductory shots outside the hospital and an interview with the administrator of the hospital. It gives an overview and provides the audience with a context for viewing the remainder of the video.

Microcomputer uses within the hospital. This section highlights two uses of microcomputers within the hospital. First, the director of the Pearson Computing Centre program for Microcomputer Training for Employment of the Physically Disabled is interviewed. This is a 19 week program designed to train physically disabled persons to work in the microcomputer industry. The program focuses on (1) skills training in accounting, database management, electronic spreadsheets, word processing, and operating systems (14 weeks), and (2) employment preparation emphasizing interpersonal communication skills, confidence building, skills analysis, resume writing, telephone skills, interview practice, work experience, and identifying potential employers (5 weeks). The program has achieved an exceptionally high job placement rate. Shots of trainees engaged in various facets of the program are interspersed throughout the interview. The second activity features microcomputer usage by a resident on one of the hospital wards. The video dramatically illustrates the interactive use of a variety of communication systems including eyegaze, facial expressions, and a communication board; a wheelchair mounted Scanwriter with memory and voice synthesis; and a communication system utilizing switches and a Tetrascan to operate a personal microcomputer and printer for word processing and other activities. The video provides a good illustration of the "multi modal" model of communication systems being advocated in the professional literature (Kraat, 1985; Vanderheiden, 1984).

Computer uses within Pearson School. This section includes an overview of the program and physical layout of the school and presents brief vignettes, involving 22 residents, which highlight the software and special adaptive technology they use in accessing microcomputers for various purposes. The viewer is made aware of adaptive devices including Tetrascan, key locks, mouthsticks, keyguards, ECHO synthesizers, disk guides, single and dual switches, pneumatic sip and puff entry, Morse Code input, Adaptive Firmware Card, a communications modem, Unicorn keyboard; and software programs such as textalker, Bank Street Writer, Talking Word Board, Whole Brain Spelling, Talking Blissapple, Applesoft Basic programming language, Handicapped Typewriter, Modem Magician, Applewriter II, Kinsmen Scanning Trainer, Motor Training Games, Magic Window II, Appleworks, Wordstar, Megaword, and various game programs.

Conclusion. A short segment on telecommunications in which a resident demonstrates use of a modem to contact bulletin boards and other information sources outside the hospital concludes the two hour video. The final segment lists the credits. The names of the organizations contributing to the video, ad the names of participating residents and others involved in production, scroll past with music being played in the background.

Switch assessment and Adaptive Firmware Card videos. One 42 minute video was produced to provide an overview of the switch assessment process and to demonstrate use of the MSIP (Movement, Switch, Interface, Position) microcomputer switch assessment program published by The Hugh Macmillan Medical Centre in Toronto (Milner, Parnes, McNaughton and Lotto, 1983a, 1983b). In this video, two occupational therapists conduct an MSIP assessment with a resident of the hospital. The second 35 minute video presents information on the Adaptive Firmware Card (Adaptive Peripherals Inc., 1984), demonstrates its technical characteristics, and illustrates its use with a resident accessing a word processing program with sip and puff Morse Code entry. Both the videos can be used to supplement inservice training activities on switch assessment and use of the AFC.

Some Final Comments

Based on our experiences, the following 15 suggestions are offered for those contemplating video production projects in special education/rehabilitation.

(1) Don't skimp, buy plenty of good quality videotape.

(2) Allow lots of time for editing.

(3) Have backup equipment available.

(4) Carefully plan your work an work your plan.

(5) Alert those who loan equipment that damage is possible accidents to happen.

(6) Use good microphones to capture sound.

(7) Watch your lighting, try for consistency from shot to shot.

(8) If possible, have two cameras for shooting.

(9) Make an effort to keep everyone involved informed of plans and changes as shooting progresses.

(10) Don't be afraid to shoot extra footage, it can come in handy during editing.

(11) Do a pilot project first to gain experience, try out equipment and work out setup problems.

(12) Don't forget to include a well organized list crediting those involved in the production.

(13) Have action and movement in your shots, avoid too any "talking heads."

(14) Allow for some formative and summative evaluation.

(15) Expect Murphy's Law to rear it's ugly head!

REFERENCES

Adaptive Peripherals Inc. (1984). Adaptive firmware card version 2e. Seattle; Author.

Brubacher, C. (Ed.) (1985). Technology - a bridge to independence. Proceedings of the Eighth Annual Conference on Rehabilitation Technology. Washington: Rehabilitation Engineering Society of North America.

Bunch, J. (1983). Our challenge. Training and Development Journal, 14-16.

Donrath, M., Friedman, H., & Carlson, M. (Eds.) (1986). Employing technology. Proceedings of the Ninth Annual Conference on Rehabilitation Technology. Washington: Rehabilitation Engineering Society of North America.

Heilveil (1983). Video in mental health practice. New York: Knowledge Industry.

Hope, T.W. (1984). Audiovisual media uses and expenditures in training. Education media yearbook, 94-97.

International Television Association (1985). ITVA Canada formed. A/V Business Communication, 35.

Kraat, A. (1985). Communications interactions between aided natural speakers: A state of the art report. Toronto: Rehabilitation Council for the Disabled.

Long, D. (1984). Canada leads U>S> in A/V use. A/V Canada, 20.

Milner, M., Parnes, P., McNaughton, S., & Lotto, W. (1983a). Towards creative use of computers by severely disabled persons through adaptive interface systems. (Appendices C1, C2, C3). Toronto: The Hugh Macmillan Medical Centre.

Milner, M., Parnes, P., McNaughton, S., & Lotto, W. (1983b). Towards creative use of computers by severely disabled persons through adaptive interface systems (Progress Report). Toronto: The Hugh Macmillan Medical Centre.

Stride, B. (1982). Computers and the severely physically handicapped: A pilot project at Pearson Hospital. Canadian Journal of Occupational Therapy, 49(4), 125-128.

Vanderheiden, G.C. (1984). Augmentative communication: Trends and priorities in research and delivery. Special Sessions. Second International conference on Rehabilitation Engineering. Bethesda, MD

The Child With Attention Deficit Disorder: Finding A Safe Place To Learn Problem Solving

Cynthia Terwilliger
Learning Development Services
San Diego, California

Abstract

This paper discusses the author's current research and describes the ways that educators and therapists are using computers to teach problem solving to children with Attention Deficit Disorder (ADD). The author makes recommendations that will be helpful for both the parents and teachers of ADD children for structuring a problem solving program. A list of commercially available software is provided, as well as a list of sources for printed programs.

Introduction

Attention Deficit Disorder is prevalent in the school age population, affecting as many as 3% of prepubertal children. Every regular classroom teacher will probably have one of these children in his/her class--a child (usually a boy) who is hyperactive, unable to attend to either group or individual tasks for any period of time, and generally unsuccessful at both academic and social activities. These children are frustrating to their parents and teachers because they are of at least normal intelligence and can be very personable and inquisitive in a one-to-one learning situation, sharing every child's delight in exploration and discovery. Yet in a large group of children where they are expected to display self control, such as in a classroom environment, the ADD child is often disruptive, demanding extraordinary amounts of the teacher's attention and patience, and although he is always busy, he is seldom busy with an assigned task.

Because of their lack of ability to focus their attention, ADD children may miss the problem solving cues and strategies that are learned by a normal child. They are often not attending to the process by which an academic or social problem is solved.

It is the challenge of parents and educators of ADD children to design "safe" places for them to learn. Computers, complete with appropriate software, are a logical solution. For a child who has difficult focusing his attention, computers offer intrinsic fascination which will keep him on task longer. For a child who has experienced ridicule from his peers because he is behind scholastically, computers offer privacy to explore simple concepts and gain fundamental skills. For a child who has repeatedly exasperated his parents and teacher, the computer is a teacher whose patience cannot be exhausted.

Computers can be a safe place for an ADD student to learn, and of primary importance is the study of problem solving skills which can then be applied to regular academic and social situations. Computers can present the student with random and unpredictable events. Then, in the safe environment of a computer program, the ADD child may become better prepared to deal with unexpected problem situations by practicing the generation of back-up plans and alternative solutions.

Suggestion: Gather existing software to design a program in problem solving

This suggestion is especially applicable when teaching social problem solving skills to ADD children. Philip C. Kendall's book Cognitive-Behavioral Therapy for Impulsive Children, offers a twelve session program to help children learn to stop and think. The program offers suggestions for a set of self instructions, such as saying to yourself "What am I supposed to do?", "Look at all the possibilities," "Focus in," "Pick a solution," and "Check out the answer and tell yourself you did a good job." The book provides many suggestions for activities which a child and therapist may perform together while practicing the problem solving strategy.

Gail Fitzgerald at Project Iowa has adapted Kendall's program to the computer in a pilot study and compared the progress of students who experienced activities with non-computer classroom materials with students who experieed computer activities. A search of available software revealed the situation with which special educators are painfully aware: precious little software has been developed specifically for the learning disabled population. So Fitzgerald used the available software and compared such activities as the familiar Etch-A-Sketch with software maze programs such as "Cooperation Maze" by Edutech. She compared Broderbund's "Print Shop" with the use of a variety of bulletin board materials. Fitzgerald found that the group using computer-assisted training showed a significant improvement over time as measured by their performance on Porteus Mazes. In addition to the implication that computers improve achievement for learning disabled children, this study encourages the discerning teacher and parent to choose a wide variety of available software and then use it in a problem solving context.

Software for Use in a Teacher-Designed Problem Solving Program:

Choplifter, Broderbund.

Cooperation Maze, Edutek.

Delta Drawing, Spinnaker.

Face Maker, Spinnaker.

Gertrude's Secrets, The Learning Company.

Koala Pad, Koala Technologies Corp.

Microzine, Scholastic Inc.

Miner 2049er, Micro Lab, Inc.

Rocky's Boots, The Learning Company.

Sneakers, Sirius Software, Inc.

Snooper Troops, Spinnaker.

Suggestion: Use the programs that are printed in books and magazines

For teachers who are on limited budgets which do not allow the purchase of much software, many books and magazines publish the code for programs that are useful for ADD students. The programs are typically written in either BASIC or LOGO, for any of the popular microcomputers, and will not contain graphics, as graphics require more sophisticated programming. Many programs have been written for students with very specific learning impairments that will also be helpful for the ADD student.

The author's experience leads her to recommend that the teacher or parent not expect the ADD students to participate i the preparation of the program (entering the code into the computer). Copying code into the computer requires accurate typing skills, or errors will result when the program is run. The first choice is to acquire an extremely accurate typist who will copy he code into the computer. Another option is to train a group of non-ADD students who are interested in computers to enter the code, and de-bug it. This is an exercise in problem solving for the non-ADD students, also. Or the last option is for the teacher or parent to prepare the program for the ADD student. Once these programs are prepared, they will provide a good library of very inexpensive software that a teacher or parent may use while designing a program for the ADD student.

Sources of Printed Code for Software Programs

"Cognitive Rehabilitation: A Publication for the Therapist, Family and Patient." 6555 Carrollton Ave., Indianapolis, IN 46220. A monthly journal that always includes both hardware/software review and the printed code for simple programs that have been used to remediate attentional deficits.

"Computing Teacher." Journal of the International Council for Computers in Education, University of Oregon, 1787 Agate Ste., Eugene, OR 97403-1923. Usually contains an article and code for a program using BASIC, and a different article on using LOGO in a classroom environment.

Tim Hartnell, *Giant Book of Computer Games*. Ballantine Books, New York, 1985. Over fifty programs in BASIC code, including many games and challenges that could be incorporated into an educational program.

Tom Rugg and Phil Feldman, *More than 32 BASIC Programs for the Commodore 64 Computer*. dilithium Press, Beaverton, Oregon, 1983.

Suggestion 3: Use software that has been designed to teach problem solving skills to regular students

This author's research involves using Sunburst's program, *Memory: The First Step in Problem Solving with* ADD students.

Memory is a thoroughly designed sequence of lessons for children in grades k through 6 which includes both 50 lessons and 10 diskettes. *Memory* was tested on regular classroom students during its three years of development in the Rochester School District. The author's work applies these lessons and software to ADD children (as identified by the Revised Conner's Questionnaire). Preliminary results indicate that ADD students can also show gains in problem solving ability. However, a large range of ability has also been found, with some subjects remembering 10 to 13 items after treatment, and some subjects remembering only one or two items.

In addition to the growth in problem solving ability, ADD students showed two other significant behavioral changes. Students exhibited improved attention spans, often persisting in computer oriented tasks beyond the required lesson time. And students developed a spirit of cooperation and engaged in peer teaching. Students preferred to work in pairs rather than one-to-one with the computer, dispelling the myth of the isolated child captive to a computer screen.

Parents and teachers who are adopting a problem solving program for use with ADD students may need to modify the software of lesson design slightly. Be aware of these areas which may be particular problems for ADD students:

Comparison Kitchen, DLM Teaching Resources. Preschool to 1.
Ernie's Big Splash, CBS Interactive Learning. Preschool to 1.
Freddy's Puzzling Adventures, DLM Teaching Resources. Grade 2 to 6.
Gears, Sunburst. Grade 1 to 12.
Jack and the Beanstalk, HRM Software. Grade 2 to 8.
Memory: The First Step in Problem Solving, Sunburst. Grade K to 6.
Remember!, DesignWare, Inc. Grade 7 to Up.
The 4th R--Reasoning, MCE Inc. Grade 3 to 7.
The Factory: Strategies in Problem Solving, Sunburst. Grade 2 to 12.
The Incredible Laboratory, Sunburst. Grade 3 to 12.

Conclusion

Computers can create an atmosphere of success for academically unsuccessful children. The use of appropriate software can create an atmosphere where imaginative ideas are treated with respect and judgment is temporarily suspended. Good programs provide situations where maximum support is provided and success is highly probable. Given the importance of using the computer with learning disabled children, such as many children with ADD, three suggestions are made for parents and teachers: Assemble existing software and design a problem solving program, prepare programs from printed materials, or adopt and modify a program that was designed for non-learning disabled students.

References

Book, Robert M., Management of the child with attention deficit disorder in the school setting. Paper presented at the annual convention of the American Psychological Association (91st, Anaheim, CA, August 26-30, 1983).

Diagnostic and Statistical Manual of Mental Disorders, III.

Fick, Landis F., Fitzgerald, Gail E., and Milich, Richard. Computer applications for students with behavior and learning problems. Iowa City: Project Iowa, 1984.

Goldstein, Michael. The multi-disciplinary evaluation and treatment of children with attention deficit disorders. Neurology, Learning and Behavior Center, 670 East 3900 South 100, Salt Lake City, Utah 84107.

Kendall, Philip C. and Braswell, Lauren. Cognitive-behavioral therapy for impulsive children. New York: The Guilford Press, 1985.

Stearns, Peggy Healy. Problem solving and the learning disabled: looking for answers with computers. Journal of Learning disabilities Feb. 1986, vol 19, no. 2, pp. 116-120.

Stranger, Donna. Computer assisted problem solving skill practice project -- year three. Unpublished manuscript, Rochester Independent School District #535, August, 1983.